# WILDLIFE HABITAT REQUIREMENT SUMMARIES FOR SELECTED WILDLIFE SPECIES IN ALBERTA

Alberta
ENERGY AND
NATURAL RESOURCES
Fish and Wildlife Division

# WILDLIFE HABITAT
# REQUIREMENT SUMMARIES
# FOR
# SELECTED WILDLIFE SPECIES
# IN ALBERTA

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## 1. SPECIES HABITAT REQUIREMENT SUMMARIES: AN INFORMATION BASE

This manual attempts to summarize and highlight information to assist in defining species/habitat relationships relevant to Alberta environments and for a number of Alberta wildlife species. The degree of specificity of the summaries, in part or whole, varies according to the background information available. Information must often be extrapolated from studies outside Alberta, or from specific regions in Alberta; this should be taken into consideration when applying this information. The summaries have been reviewed by species experts and their comments have been incorporated. Habitat distribution maps follow the summaries; a comparative Wildlife Habitat Region map for Alberta (Figure 1) is provided.

It is hoped this manual will serve as an information base, and as a reference guide for habitat mapping and evaluation activities. The summaries are being used as an integral part in the development of habitat interpretation models which attempt to establish quantifiable value relationships between landscape features and species life requisites. These models will allow the classification of habitat suitability for a particular region on a species basis. The background information provided in the summaries supports the relative values assigned within the models for a particular habitat region.

Wildlife requires a number of life support requisites for survival and reproduction. Habitat features that will supply food, cover, and space will determine a species' presence or absence from an area, as well as influencing the relative abundance of a species. Food (vegetative or animal matter, water, and trace minerals) should provide all the nutritional requirements necessary for growth and development, maintenance and reproduction. Cover may be required for thermal, reproductive, escape, resting and roosting purposes. A number of landscape components, such as vegetation, land forms, topography, and aquatic forms, may serve these functions. Space is the area or range an animal requires to satisfy these basic requirements during its lifetime.

The habitat requirements of a species vary seasonally, and with sex, age, and reproductive status. As well, many habitat components (vegetation, snow cover) undergo dramatic seasonal changes or gradual successional changes that will temporally influence the suitability of a region. Disturbance phenomena, natural as wildfires or human-induced as timber harvest, may also have a significant effect on habitat suitability. Effects may be species-specific or species-general, and harmful or beneficial to varying degrees.

Species characteristics will determine the components of the habitat essential to its existence. Species plasticity influences the range of habitat conditions that a species can adapt to. Sage grouse, for example, are dependent on expanses of sagebrush and cannot exist elsewhere. Elk, in contrast, are a generalistic species able to utilize a wide variety of habitats under varying conditions. Before accurate evaluations of wildlife habitat of such species can be made, an adequate information base of their habitat needs, and the factors influencing these needs, is required.

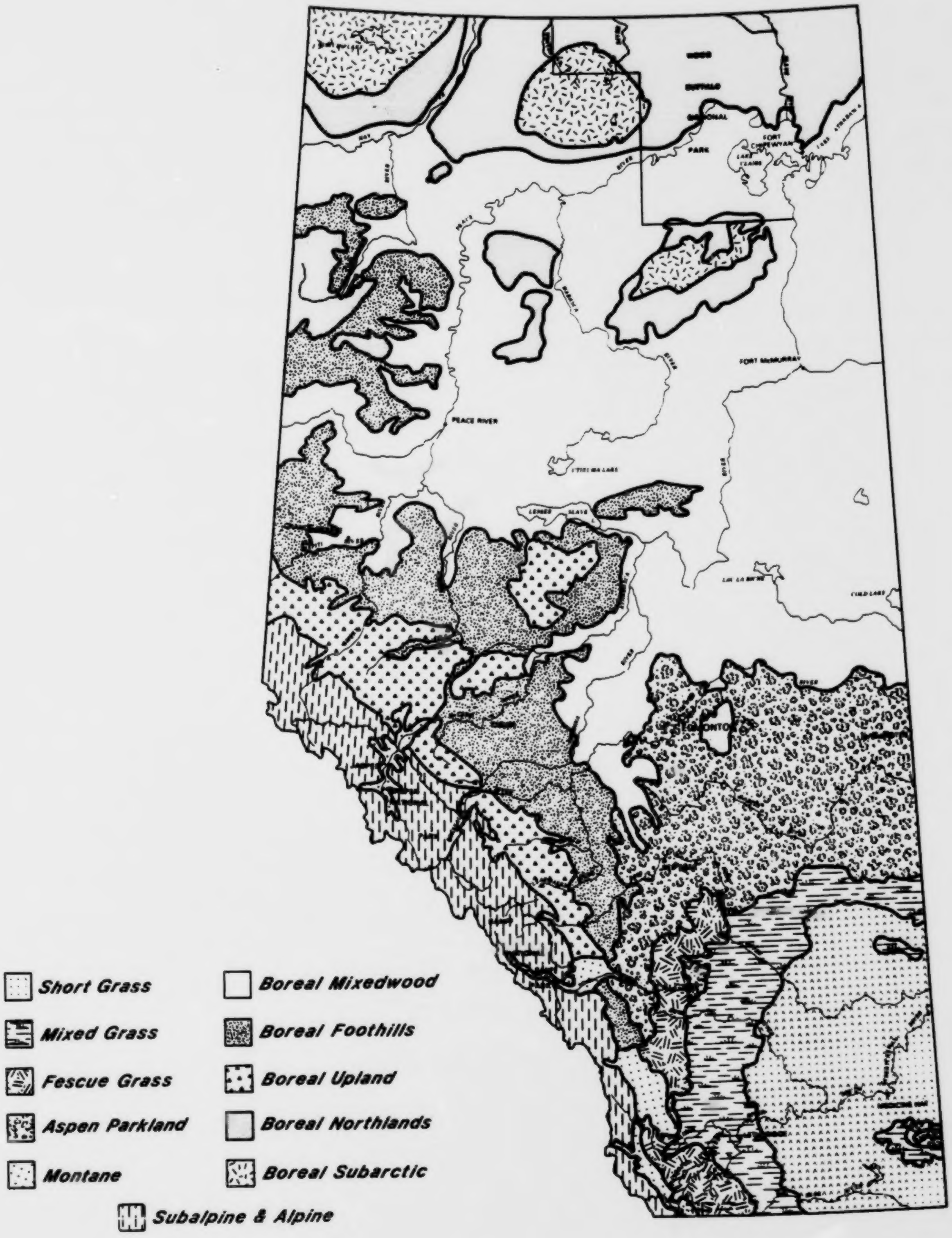
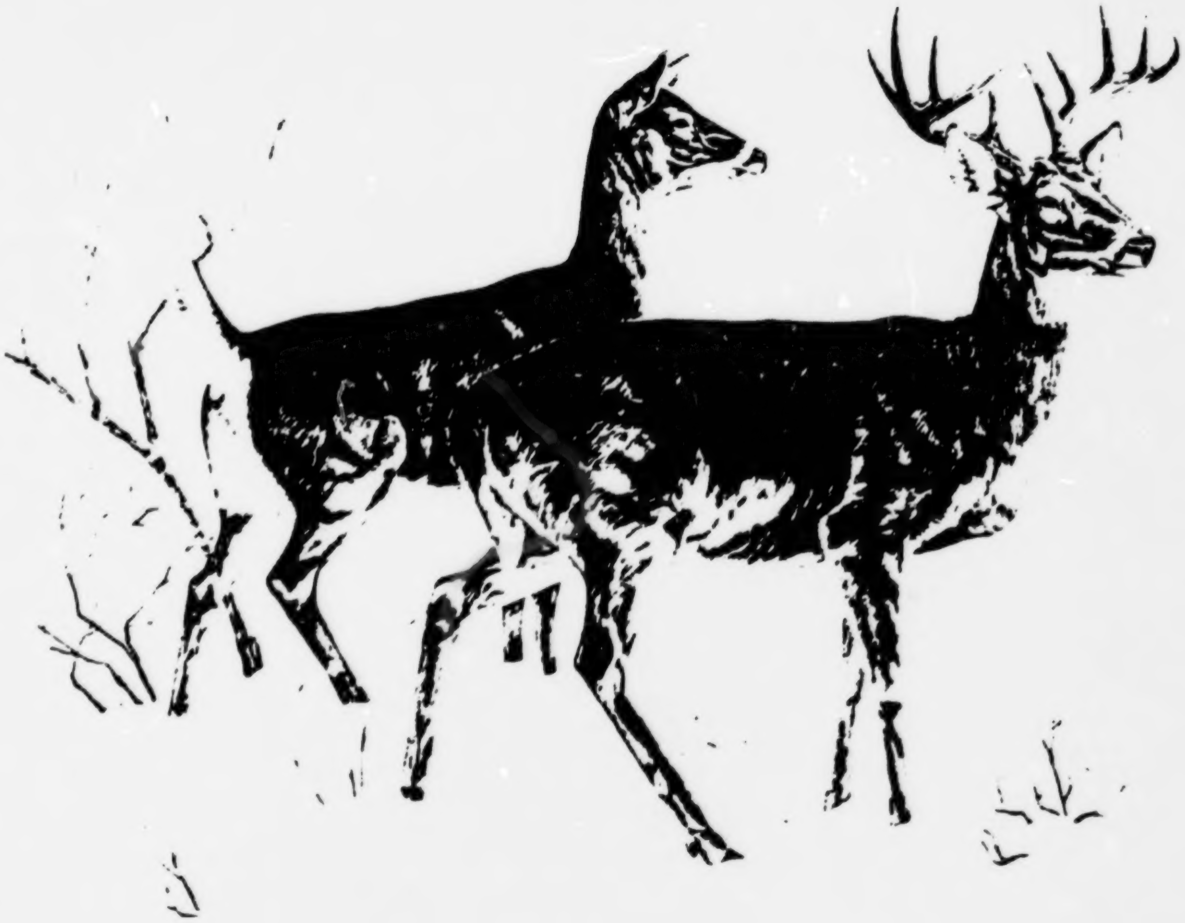


Figure 1. Wildlife Habitat Regions of Alberta.

# WHITE-TAILED DEER



# 2. KEY HABITAT REQUIREMENTS FOR WHITE-TAILED DEER

## 2.1 General

White-tailed deer (*Odocoileus virginianus*), a very adaptable species, is found in three major ecological zones: grassland, aspen parkland and boreal mixedwood forest. Its optimum habitat is the aspen parkland where woody cover, diverse in height and species composition, and containing a high frequency of edge, occurs in proximity to farmland so both food and cover requirements are adequately met.[9,11] In the grassland the white-tailed deer is mainly confined to brushy and wooded river flats because of cover requirements, and in the boreal mixedwood severe winters with deep snow restrict deer to its southern regions.

The distribution and relative quality of white-tailed deer habitat in Alberta are depicted in Figure 2.

## 2.2 Cover

### 2.2.1 Vegetation

Trees, shrubs and tall herbaceous vegetation are all relied upon heavily for shelter and security.[13]

In the agricultural portions of the province, winter cover is best provided by native aspen (*Populus tremuloides*) parkland and groveland in parcels of 0.4 km$^2$ or larger and along major wooded river valleys. Smaller tracts of cover may be sufficient if the climate is mild, as in the prairie region.[13]

Dense stands of snowberry (*Symphoricarpos albus*), rose (*Rosa* sp.), silverberry (*Elaeagnus commutata*), choke cherry (*Prunus virginiana*), willow (*Salix* sp.) and tall herbaceous vegetation, either alone, complexed, or in association with treed areas, provide excellent cover.[13]

In the boreal mixed-wood on spring-fall and summer range, deciduous, coniferous and mixed-wood trees and shrubs ≥ 1.5 m tall with > 75% crown closure are best for thermal cover. Stands < 1.5 m can be used if the stand is at least pole size and has ≥ 60% crown closure.

Thermal cover requirements are the same on winter range except that coniferous stands, developed at least to the pole-sapling stage, are used more heavily.[15]

Well developed understory vegetation is preferred in winter but not on summer range.[16]

The optimum size of stands for thermal cover is 0.8-2.0 ha, for hiding cover is 2.6-10.5 ha and for fawning cover is 0.4-2.0 ha.[16]

Optimum fawning habitat in forested regions includes low shrubs or small trees from 0.6-1.8 m under a tree overstory of 50 per cent crown cover closure.[14] Aspen groves and willow-aspen rings are ideal in the parkland.[13]

### 2.2.2 Land Forms and Topography

Though topography is significant as cover, it cannot substitute for vegetation, only increase its value.

Wooded river flats, coulees and floodplains provide protection and are especially important in the grassland regions.[11]

Valley slopes and eroded and hummocky terrain provide important thermal cover in winter.[6]

Rugged and steeply sloped terrain provides shelter and visual obscurity.[13]

Woody draws, drainages and basins with slope < 15 per cent are used for fawning cover.[16]

North-facing slopes are preferred in summer and fall; south-facing slopes in spring and winter.[16]

The deer prefer lower altitudes in winter; higher slopes and ridge tops in summer.[11]

### 2.2.3 Climate

Sites protected by topography or dense vegetative cover are sought out in winter.

In areas where chinooks are frequent and snow depths are shallow, smaller tracts of cover are required.

Snow depths $\geq$ 40 cm cause movement off summer ranges.[7,11]

If winters are severe and snow depth exceeds 50 cm, deer will aggregate and remain in dense stands of conifer or mixed-wood;[15] the need for adequate thermal cover (i.e. energy conservation) is very important and availability of forage becomes a secondary consideration.

## 2.3 Food

### 2.3.1 Vegetation

Food utilization reflects the availability of vegetation, therefore it is highly variable depending on the geographical region and season.

#### Grassland

Grasses and agricultural crops are consumed in spring and summer, but deer will also browse at this time if shrubs are available.[6]

Browse is the predominant food in fall and winter, but deer will also paw out waste grains and shoots from agricultural fields.[6]

Preferred browse include: choke cherry, rose, snowberry, silverberry, bearberry (Arctostaphylos uva-ursi), juniper (Juniperus sp.), red-osier dogwood (Cornus stolonifera) and aspen.[6]

Parkland

Grasses and agricultural crops such as alfalfa (Medicago sativa), barley (Hordeum sp.), and wheat (Triticum sp.) are primarily consumed in fall and spring.[6]

Browse predominates in winter but waste grains and shoots are also utilized.

In summer deer feed on browse species such as rose and aspen as well as herbaceous forage.[6]

Forest

Deer are primarily browsers of deciduous shrubs and trees in summer and winter, utilizing coniferous trees only if starving.[6,16]

The preferred seasonal browse is aspen and willow in winter; rose, snowberry, aspen and balsam poplar (Populus balsamifera) in summer.[6]

Browsing also occurs in spring and fall, but forb consumption is usually greater.[6]

### 2.3.2 Land Forms and Topography

Valley slopes, as well as hummocky and eroded terrain, promote vegetation diversity.[5]

South-facing slopes are important feeding areas in winter and spring since they have the least snow.

### 2.3.3 Aquatic Forms

Lakes, ponds and streams in close proximity to cover provide water plus succulent grasses and water plants.

The deer require available water within 180 m, especially during fawning.[16]

### 2.3.4 Climate

Deep snow restricts feeding on ground vegetation.[9] It cuts down movement, restricting access to browse.[11,15] Snow-free areas associated with chinooks and southerly slopes, are important to deer survival.

e

## 2.4 Space

### 2.4.1 Territory/Home Range

Deer usually have very small home ranges if adequate food and cover are available.[11]

In good habitat a deer may remain in an area 500-800 ha.[4,5]

Migration takes place from summer to winter range only if cold weather conditions and deep snow force the move.[11]

Home ranges are reported to be in the order of 70-190 ha during the summer, and 160-480 ha during the winter.[10]

### 2.4.2 Population Density

The mean densities of white-tailed deer for various ecological zones are measured in number of animals per linear kilometre: prairie - 0.87, parkland 1.24, mixed-wood - 0.22, foothills - 0.18 and mountain - 0.04. In the prairie/parkland densities were recorded at 2 deer/km$^2$.[1]

## 2.5 Special Considerations

### 2.5.1 Size, Shape and Juxtaposition of Habitat Components

Woody cover types which are diverse in height and species composition and occur in close proximity to farmland are ideal white-tailed deer habitat.[9,11]

Most use of land occurs within 180 m of the edge between cover and feeding areas,[16] therefore a good interspersion and juxtaposition of native and agricultural land is important.

Small openings in forested areas plus the presence of fresh water ponds, streams and rivers enhances interspersion of food and cover, and increases habitat quality.[14]

Edge or ecotonal areas associated with transition zones between treed and non-treed areas also brings suitable food and cover types into close association, and are productive of good browse species.[17]

A wide variety of natural vegetation cover types within an area is more likely to provide all habitat requirements.[2]

Small rivers, streams, meltwater channels and stringer forests provide continuous native cover for travel corridors.[12]

### 2.5.2 Significance of Disturbance Phenomena

*Agriculture*. Given adequate nutritional status, deer likely prefer natural habitats dominated by natural food.[14]

Though cultivated crops provide deer with an important supplement to their browsing, the loss of natural habitat to agriculture reduces the cover required by the deer.

Intensive agriculture improvement reduces the interspersion of native and agricultural land, isolating blocks of suitable native winter habitat and eliminating bluffs of summer habitat.[14]

The reduction of natural habitat promotes overcrowding and overutilization of existing suitable lands. This increases animal mortality and reduces productivity.[14]

Fire. Controlled burning provides more browse for deer by stimulating sprouting from understory plants and permitting more light to aid growth.[3]

Fire also increases the amount of suitable food and cover by encouraging edge, and improving nutrient recycling.[3]

Fire control allows forest maturation which removes suitable browse from the reach of deer.

Human Disturbance. If sufficient cover is available, deer will show a high tolerance to human activity. They have been highly successful in coping with hunting pressure and intensive land management.[8]

Logging. Logging creates earlier stages of vegetation succession which favors forage production, but cutting patterns must be small and irregular to enhance the interspersion of food, cover and the development of edge habitats. These edge habitats are usually narrower and more productive than natural edges.[8]

Deer will use open areas produced by clearcut logging, but prefer natural openings and burned areas.[12]

## 2.6 Limiting Factors

It is difficult to pinpoint factors that limit white-tailed deer in some areas and not in others.

Snow depth is probably the factor that limits deer movement most, and also limits distribution in the province; deer mobility is restricted by snow depths greater than 38 cm, thus in areas such as the northern boreal forest traditional winter ranges with shallow snow are critically important.[15]

In southern grassland regions deer are mainly restricted to large habitat blocks because of the scarcity of escape cover.

## 2.7 Regional Variations

In the grassland winters are mild. There is less need for thermal cover, but because of intensive human activity, protective cover is still required. The main deer concentrations occur in close proximity to sheltered, wooded locations, which often occur along river valleys.

Treed areas are scarce, so less browse is available, and deer rely heavily on grasses and agricultural crops.

The parkland region is ideal white-tailed deer habitat because the mixture of native and agricultural lands allows cover in close proximity with a good food supply.[18] Aspen groves alone are an excellent supply of food and cover.

The boreal mixed-wood is characterized by long winters with deep snow. Deep snow conditions may cause deer to yard up under heavy cover which decreases their access to browse, and may lead to starvation.

## ACKNOWLEDGMENTS

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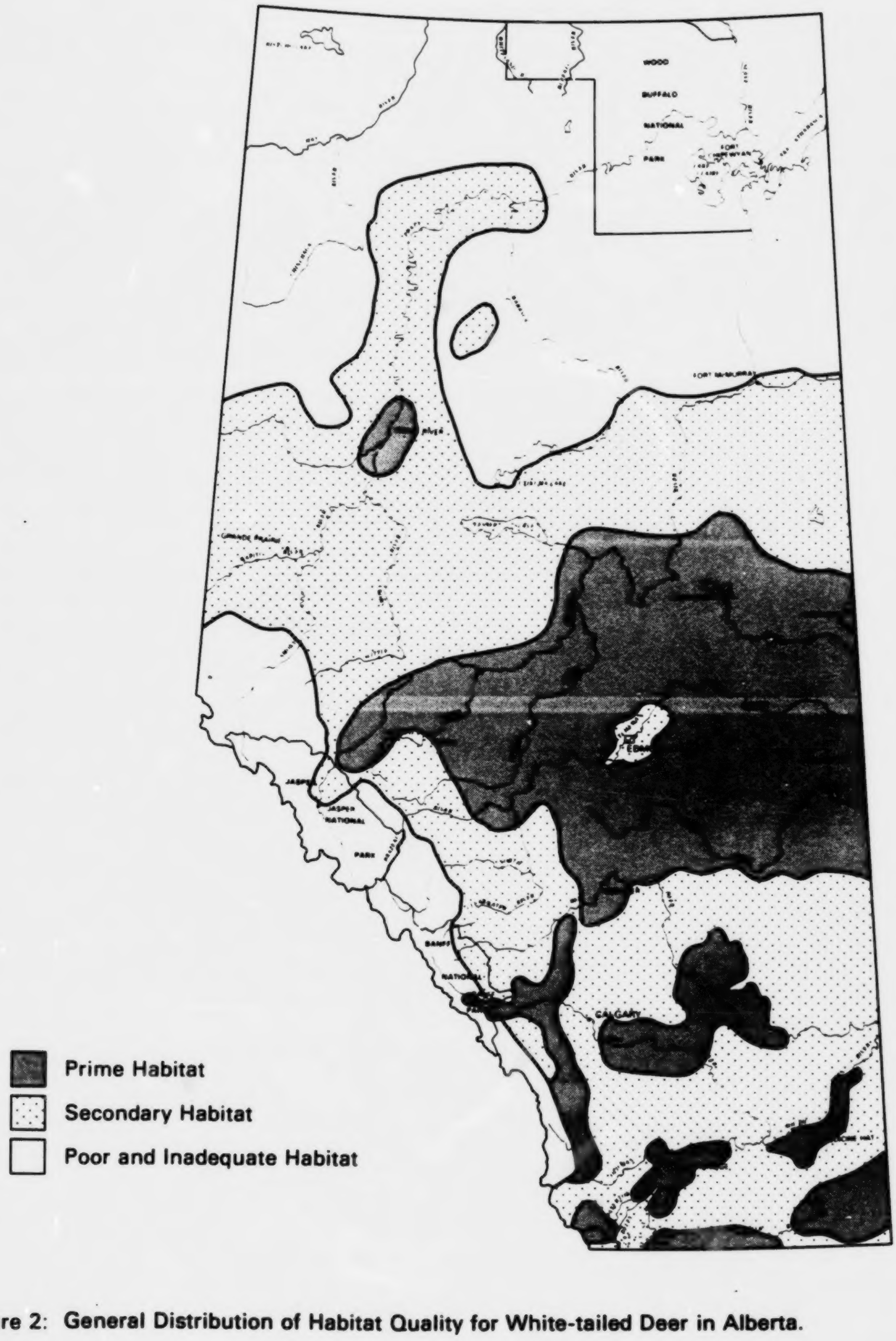

Figure 2: General Distribution of Habitat Quality for White-tailed Deer in Alberta.

# MULE DEER

# 3. KEY HABITAT REQUIREMENTS FOR MULE DEER

## 3.1 General

Although mule deer (Odocoileus hemionus) is generally considered an open country or prairie species, they are found over much of Alberta, primarily on rugged sloping terrain with native cover. Much of the best mule deer habitat occurs along river banks and breaks where there is shelter from wind, good drainage, good escape terrain and a wide variety of browse and forb species. Adequate food and cover requirements can be met by a variety of vegetation types: low shrubland, deciduous and mixed deciduous-coniferous forests.

The distribution and relative quality of mule deer habitat in Alberta is depicted in Figure 3.

## 3.2 Cover

### 3.2.1 Vegetation

In forested areas coniferous or deciduous trees and shrubs approximately 1.5 m tall with 75 per cent crown closure satisfy thermal cover requirements on summer and spring-fall range; requirements on winter range are the same but stands should be coniferous.[2]

In the foothill and mountain regions, pine-Douglas fir (Pinus-Pseudotsuga menziesii) cover types are important at lower altitudes. The spruce-fir (Picea-Abies) forest is mainly used at high elevation.[15]

In these regions the optimum size of mule deer thermal cover is 0.8-2.0 ha with a minimum width of 91 m.[2]

In prairie and parkland, shrubby and hardwood draws and wooded river valleys are available cover areas; shelter belts are used if they are on or near rough terrain.[15]

Optimum favoring habitat in forested regions consists of regenerating low shrubs or small trees between 0.6-1.8 m tall under approximately 50 per cent overstory cover[2]; in the grasslands mule deer show a preference to fawn in deciduous thickets.[15]

### 3.2.2 Land Forms and Topography

A strong association usually exists between mule deer distribution and rugged steep-sloping terrain.

In the prairie grassland, areas along valleys and eroded slopes are frequently used by mule deer.[7]

Deer use densely wooded valley bottoms to some extent in the fall, but prefer uncultivated terrain in fringe agricultural areas in the winter and spring.

Slopes of < 5 per cent are optimum for fawning habitat.[2]

### 3.2.3 Climate

Sites protected by topography or dense vegetative cover are sought in winter.

In foothill and mountainous regions, mule deer winter at the highest altitude that snow will allow; they will descend to lower elevations as snow depth increases[16] and becomes restricting (> 30 cm).[12]

Southern exposures with low snow depths are most heavily utilized in late winter and early spring.

## 3.3. Food

### 3.3.1 Vegetation

The food habits of mule deer vary greatly with season and geographic location.

In Alberta during the fall and winter seasons, mule deer paw for dried leaves of deciduous trees, especially balsam poplar (*Populus balsamifera*). Cured herbaceous vegetation browse becomes important[15] during winters of deep snow.

Mule deer prefer particular browse species: sagebrush (*Artemisia cana*), bearberry (*Arctostaphylos uva-ursi*), buckbrush (*Symphoricarpos occidentalis*), juniper (*Juniperus* sp.), poplar, choke cherry (*Prunus virginiana*), saskatoon (*Amelanchier alnifolia*) and red osier dogwood (*Cornus stolonifera*);[15] in the foothills willow (*Salix* sp.) and Douglas fir are important.

Grass is eaten in all seasons but is especially important in spring.[15] Grass composition likely increases in association with agriculture, i.e. Alberta prairie mule deer.

In summer new leaves of shrubs and forbs are used extensively; berries are also preferred.[15]

In autumn, shrubby vegetation is most important though forbs may make up 25 per cent of the diet.[5]

Mule deer will feed on agricultural crops, especially alfalfa (*Medicago sativa*), winter wheat (*Triticum* sp.), fall rye (*Secale cereale*), oats (*Avena sativa*) and on garden produce.

### 3.3.2 Land Forms and Topography

Southern exposures with the least snow allow best access to grasses and forbs in early spring.[10]

### 3.3.3 Aquatic Forms

Optimum mule deer habitat has open water within 0.8 km of any point; heaviest use of an area occurs within 300 m of water.[2]

Free water is less important in areas of succulent forage.[14]

Riparian and wetland zones are heavily used because of their palatable vegetation.[2]

### 3.3.4 Climate

Deer can remain in areas with up to 45 cm of snow[3], but the amount of forage available is drastically reduced, particularly herbaceous species.

Deep snow cover during the winter season restricts foraging so that 75 per cent or more of the diet is browse.[5]

Snow of high density, almost regardless of depth, eliminates the availability of herbaceous forage.

### 3.3.5 Trace Elements

Natural mineral licks are used by deer, particularily in summer months.[15]

## 3.4 Space

### 3.4.1 Territory/Home Range

Mule deer in the mountains may make an annual migration from high elevation summer range to lower winter range.[16]

In Montana, mule deer travelled on average 9.4 km to summer range and 11.7 km back to winter range.

They will usually remain on the same range all year if snow depths are not restrictive, and high quality forage is present.

In Montana, summer and winter home ranges were approximately 3 $km^2$ and 13 $km^2$, respectively.[11]

### 3.4.2 Population Densities

The following mean densities of mule deer for 1965 to 1974 are shown as number of animals per linear kilometre: prairie - 1.25, mixed-wood - 0.11, parkland - 0.43, foothills - 0.36, and montane - 0.11.[1]

## 3.5 Special Considerations

### 3.5.1 Size, Shape and Juxtaposition of Habitat Components

Interspersion of food and cover is essential to mule deer habitat. Unbroken areas of climax boreal forest and open grassland devoid of shrubs and trees limit use by deer.[15]

In forested areas mule deer show a heavy use of natural openings with adjacent escape cover; for optimum use, openings should have no point farther than 180 m from the edge of cover.[2]

Open areas will be used readily if they are screened from roads by vegetation and topography.[4]

The optimum size of openings is 10.5 ha.[2]

For adequate cover mule deer usually make use of the added effect of rugged, steep-sloping topography and native shrub and tree vegetation.

Travel lanes with protective cover between timbered drainages are important in forested regions; the optimum width is 130-180 m.[2]

### 3.5.2 Significance of Disturbance Phenomena

Logging. Clearcutting of lodgepole pine (Pinus contorta) and spruce-fir forests in narrow strips increases forage production by opening the canopy and allowing growth of understory vegetation; this also creates prime fawning habitat.[16]

Road building that accompanies timber harvest in many areas is detrimental because it destroys habitat and opens new access to the public.[16]

The open canopy creates greater snow accumulations which may restrict deer mobility (if > 30 cm).[15]

Fire. Decades of fire suppression has altered ecosystems and created vast stands of extremely dense timber unfavorable for mule deer.[14]

Small burns improve deer habitat by creating temporary openings.

Depending on the fire intensity and the season when the fire occurs, burns can increase the diversity and abundance of understory plants.[8]

Controlled burns have increased forage on mule deer ranges in Northeastern Washington.[4]

Agriculture. The expansion of cultivated land decreases mule deer range because of the removal of the native vegetation required for food and cover.

Programs, such as Buck for Wildlife, try to retain critical prairie habitat for deer; this is especially important in southeastern Alberta and along river breaks in the south.

Overgrazing by livestock alters native plant composition by decreasing the abundance of almost all woody species important to mule deer.[6]

Human Disturbance. Mule deer prefer areas of reduced human activity and are less adaptable than white-tailed deer, particularly in regards to hunting pressure.

Roads and highways often disrupt normal migratory and daily travel routes.[15]

Forage along roadsides and salt on highways often attracts deer. The results are increased mortality.[15]

## 3.6 Limiting Factors

Winter weather conditions, especially snow depth, are a major limiting factor for mule deer in northern regions.[5,9]

Studies in Alberta indicate that 30 cm of snow is restrictive to deer movement, while deer avoid areas with snow depths greater than 45 cm.[12,13]

Because of deep snow conditions in some regions such as the foothills and northern regions, traditional wintering areas which have little snow accumulation are critically important.[12,13,14]

In areas of intense human activity, escape cover, such as found in river valleys, is very important.

Predation, except by man, has not restricted the geographic distribution of mule deer and has never been the principal cause of a population decline.[14]

## 3.7 Regional Variations

Mule deer are ideally suited to the semi-open natural vegetation cover of prairie and parkland areas. Intensive agricultural development and human disturbance, however, have largely restricted their distribution to localized areas of rough and broken topography associated with river valleys, eroded escarpments and sand hill complexes.

Mule deer are abundant and widely distributed throughout the foothills and mountains of the Eastern Slopes where they prefer steep topography and partially treed lands associated with valley slopes and bottom-lands, south-facing slopes, tree-line subalpine and montane environments. Conifer stands are utilized for thermal and hiding cover.

Mule deer are more thinly distributed through the southern portions of the boreal mixed-wood forest, and again prefer the more rugged valley complexes and south-facing slopelands where browse conditions are good and snow depths are not restrictive during winter.

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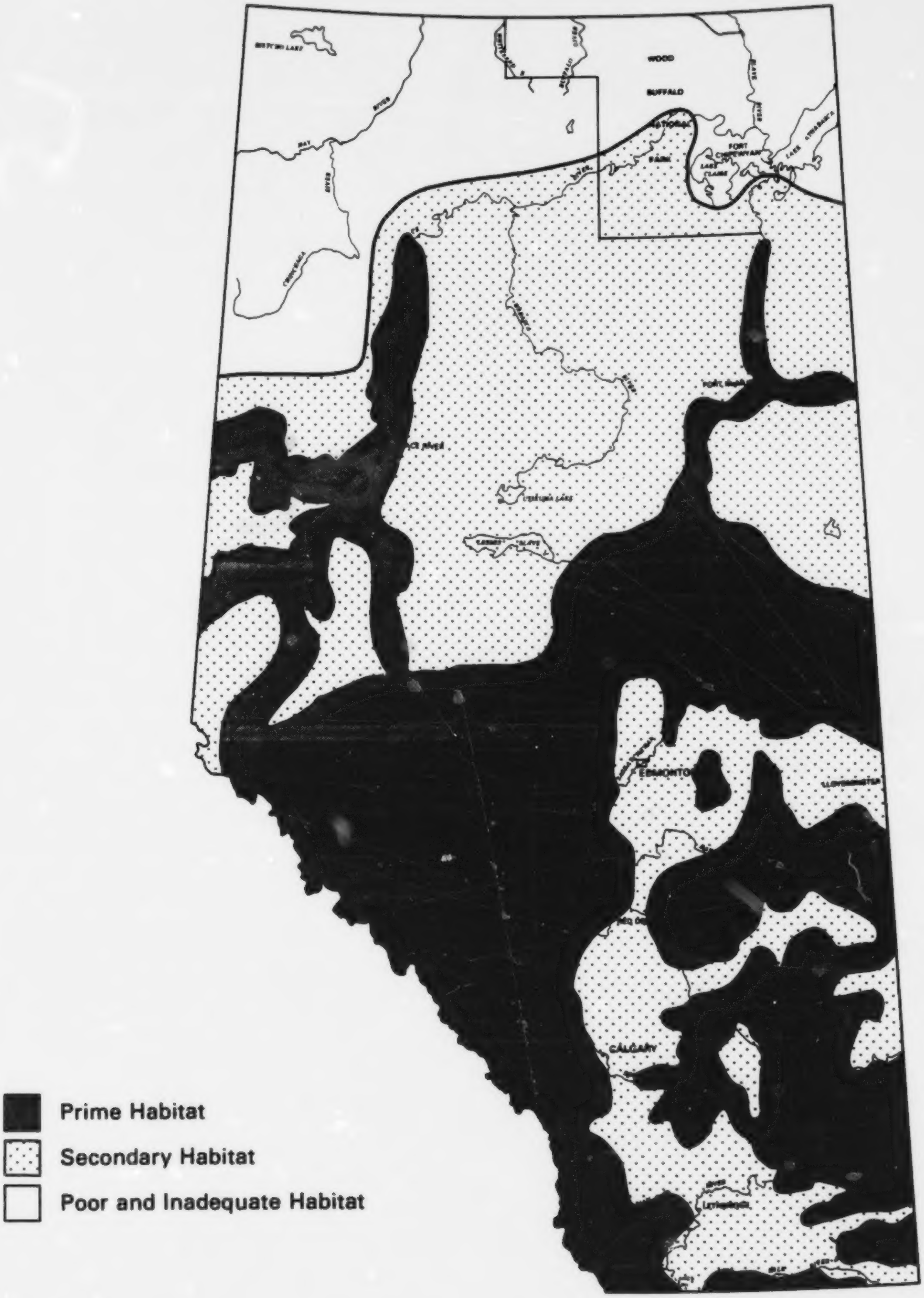
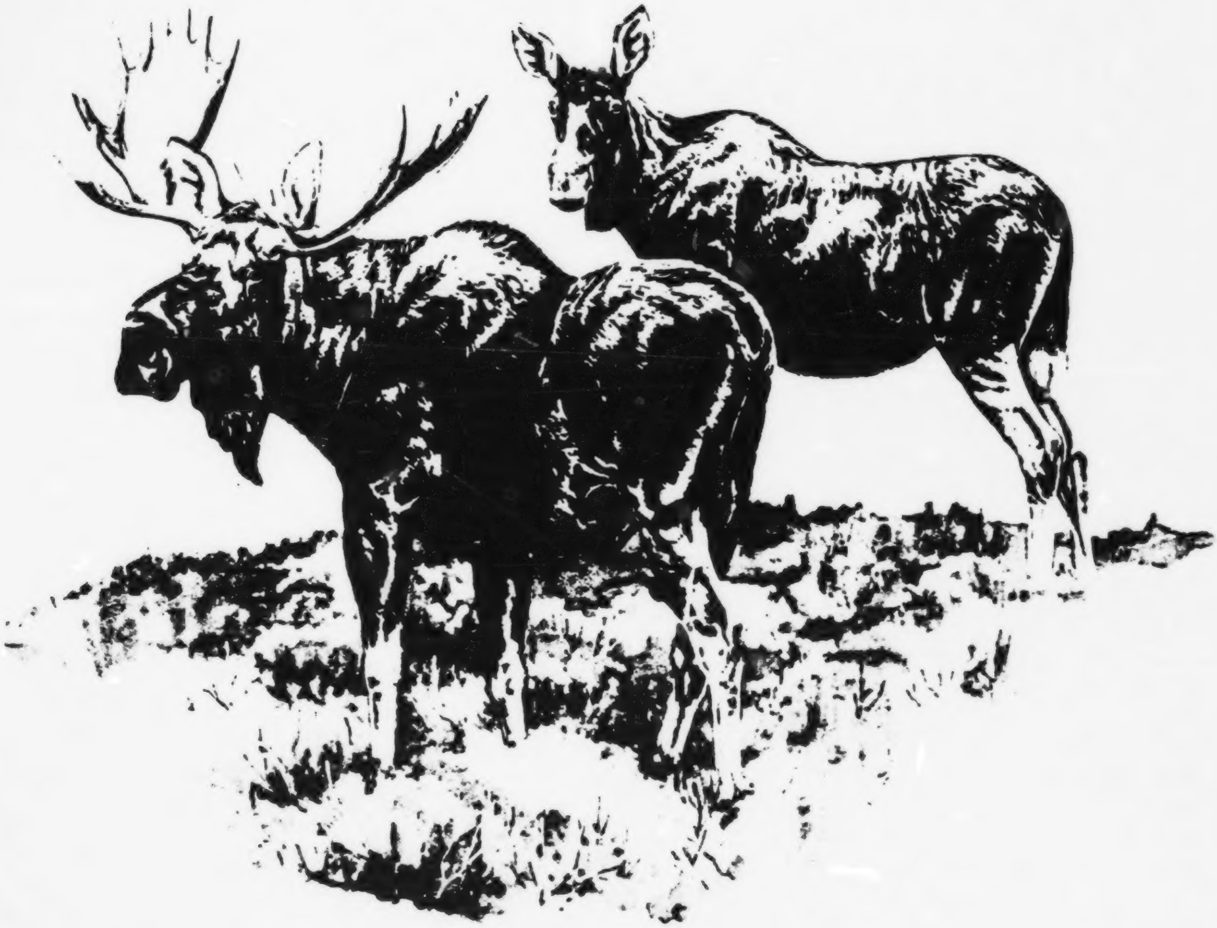


Figure 3: General Distribution of Habitat Quality for Mule Deer in Alberta.

# MOOSE



# 4. KEY HABITAT REQUIREMENTS FOR MOOSE

## 4.1 General

Moose (Alces alces) occupy a range of habitat types within forested areas. They are primarily browsers and favour immature forest shrubland for food while dense woody forest areas are utilized for cover. Preferred habitat is the early stages of mixed-wood forests with a great diversity of deciduous woody vegetation. Fire-induced forest regeneration usually provides ideal forage. The presence of aquatic environments creates edge-type vegetation communities which are diverse in composition and provide important food items during summer.

The distribution and relative quality of moose habitat in Alberta is depicted in Figure 4.

## 4.2 Cover

### 4.2.1 Vegetation

Dense, mature, coniferous forest is utilized as shelter from severe winter conditions such as low temperatures and wind, as well as an escape from harassment by insects during summer.[6,7,12]

Mixed-wood and deciduous forests can be utilized throughout the year though moose tend to abandon deciduous forests during winters of deep snow.

During summer moose select tree muskegs and immature aspen stands > 10 m in height for cover.[14]

Both deciduous and coniferous cover should have closed canopies for optimum hiding cover and winter shelter.[14,17]

The cover should be at least 200 m wide to meet hiding and shelter requirements.[15]

### 4.2.2 Land Forms and Topography

In northeastern Alberta moose occupy upland cover in summer.[5]

Lowlands are heavily utilized in late fall and early winter;[8,9] as snow depths increase, moose shift to densely forested uplands, preferably coniferous.[9,14]

## 4.3 Food

### 4.3.1 Vegetation

Moose are primarily a browsing species which feed extensively on the foliage and twigs of deciduous shrubs and trees. Forbs and aquatic vegetation may become an important food when available during spring and summer.[11]

Saskatoon (*Amelanchier alnifolia*), willow (*Salix* sp.), aspen (*Populus tremuloides*), red-osier dogwood (*Cornus stolonifera*), paper birch (*Betula papyrifera*), balsam poplar (*Populus balsamifera*), pin cherry (*Prunus pensylvanica*) and choke cherry (*Prunus virginiana*) are the most important browse species for moose in Alberta.[2,3,10,13] Rose (*Rosa* sp.), high-bush cranberry (*Viburnum trilobum*), clematis (*Clematis* sp.), beaked hazelnut (*Corylus cornuta*) and honeysuckle (*Lonicera* sp.) are of lesser importance.[3,10,13]

The composition of rumen samples usually reflects the relative availability and abundance of the browse species consumed. The exceptions are saskatoon which is a highly palatable and preferred species, and red-osier dogwood which is selected preferentially in the fall when the stems become red and are higher in sugar content.[10,11]

During the spring moose move into open areas where early green-up allows feeding on forbs and other newly emerged succulent vegetation.[5,11]

During summer, moose in Alberta feed extensively on deciduous leaves. Aquatic vegetation has limited importance.

Grasses and other grass-like herbaceous material may be utilized but never make up a significant part of the diet.[11,13]

Bark may be stripped off larger trees, especially in late winter and early spring when food is in short supply.[13]

Recent burns and early successional stages of the forest are most productive for moose. As forest succession advances, the overstory trees grow beyond the reach of moose and shade out the understory browse so neither are available.[7]

### 4.3.2 Aquatic Forms

Riparian habitats are an important source of palatable forage.

Moose are attracted to weedy lakes, marshes and sluggish streams where they can feed on aquatic vegetation.

### 4.3.3 Trace Elements

Aspen bark supplies moose with an important source of sodium.

## 4.4 Space

### 4.4.1 Territory/Home Range

Moose generally make seasonal movements between winter range (December to March) and summer range (April to November), coinciding with the spring thaw and freeze-up.[5]

The seasonal home range is approximately 20 $km^2$, ranging from 10-28 $km^2$, depending upon the age and sex of the animal.[8]

### 4.4.2 Population Density

The mean densities for various ecological zones are measured in number of animals per square kilometre: parkland - 1.25, mixed-wood - 1.10 and foothills -1.31.[1]

## 4.5 Special Considerations

### 4.5.1 Size, Shape and Juxtaposition of Habitat Components

Ideal moose habitat requires an interspersion between deciduous shrubland for food and heavy coniferous stands for cover.

A high density and interspersion of aquatic and wetland habitats (i.e. lakes, rivers, deltas and organic terrain) provides increased habitat heterogeneity and foraging opportunities.[3,15]

Small clearcuts and burns scattered among more mature forest also create an ideal interspersion of food and cover.

These burn/clearcut areas should be no larger than 16-80 ha to ensure close proximity to heavy escape cover.[17]

For optimum use by moose, long strips of cover should be no wider than 200 m.[17]

### 4.5.2 Significance of Disturbance Phenomena

Fire. Wildfire is the most important natural factor that has influenced moose distribution and habitat selection for at least several hundred years. Because of recent fire control, logging is becoming an increasingly important factor in creating moose habitat.[7]

Burn areas usually provide the most suitable moose browse after 10-15 years, the length of time varying with the time of year of the burn and its intensity.[17]

Logging. Clearcut areas peak in production of suitable browse for moose after 15-20 years of regeneration. This may vary depending on the type of logging method used and the type of stand removed.[16]

Three to 10 years after logging/burning, the developing vegetation will contain a much greater variety and quality of available food.[7]

Agriculture. Agriculture, of course, decreases moose habitat by removing natural food supplies and cover.[4]

Agriculture creates increased access to moose habitat resulting in greater human disturbance.

Human Disturbance. Depending on specific experience with the disturbance, moose may avoid agricultural clearings, roads and dwellings[14], or be attracted to the edge habitats created by them.

Hunting increases the need for large tracts of protective cover.

## 4.6 Limiting Factors

In Alberta, moose are not generally restricted by snow, though moose will tend to avoid areas with > 65-75 cm of snow.[18]

Distribution of moose is decided more by food requirements than tradition or shelter factors.

Moose are limited in numbers in the grassland and aspen parkland agricultural areas where tree and shrub vegetation is either non-existent or too fragmented and localized.

Moose are generally restricted to areas with large tracts of cover because of their susceptibility to human disturbance pressures.[15]

## 4.7 Regional Variations

In the Peace-Athabasca delta, willow and other deciduous types are heavily used for food and cover. Despite abundant marsh vegetation, aquatic plants are not an important food source. Saskatoon is uncommon, but is heavily browsed where it occurs.[2]

In the northeast region, conifers and aspen are most heavily used for cover; saskatoon and willow are the preferred browse.[10]

In central Alberta, deciduous or mixed-wood forests may be used for cover. Conifers are used during harsh winters. The predominant browse species are saskatoon and willow.[10]

In foothill and mountain regions, various deciduous shrubs are used for food though willow is usually the preferred species. In the Porcupine Hills, moose may winter in the open or under coniferous cover.[18]

## ACKNOWLEDGMENTS

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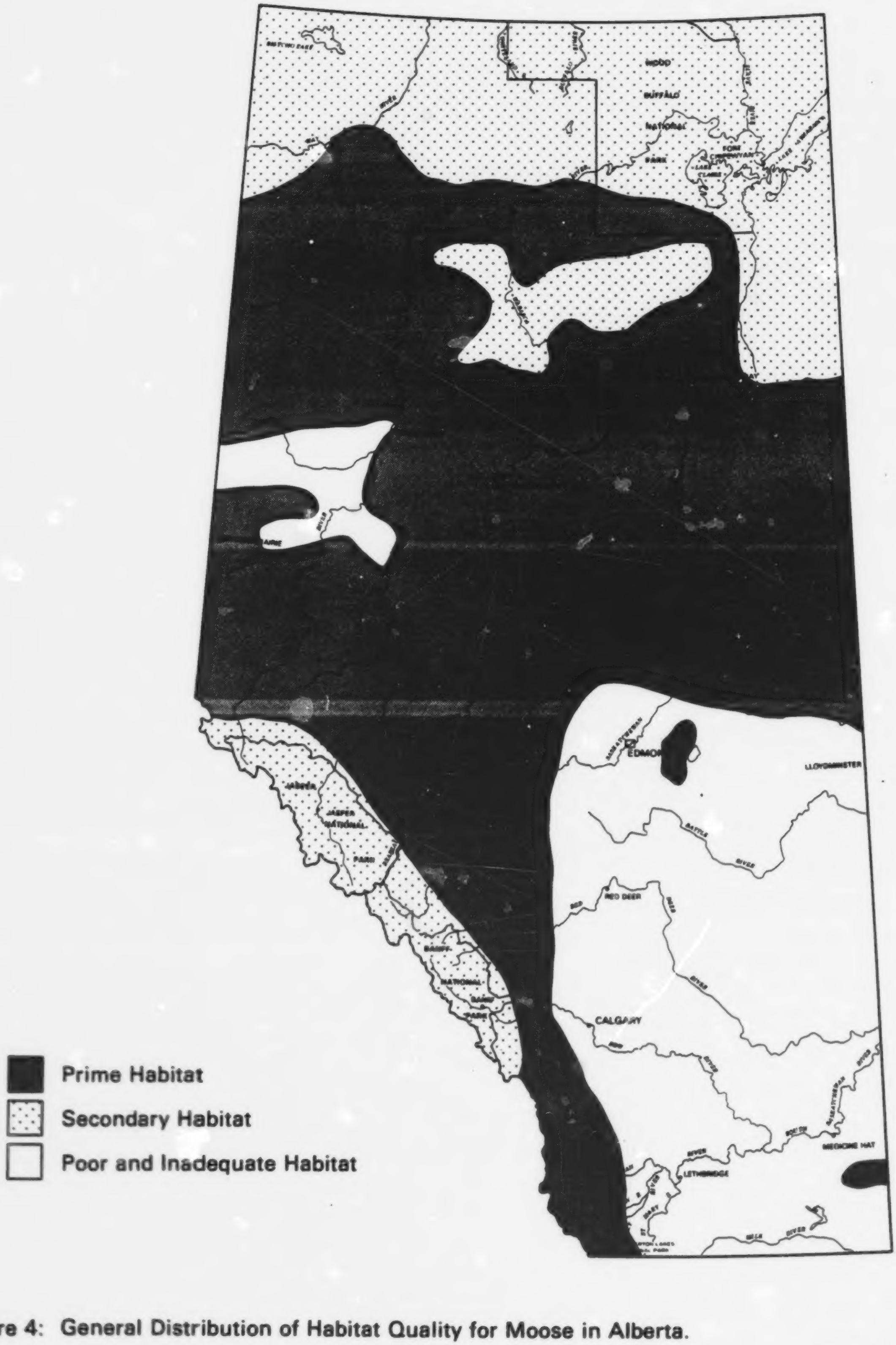
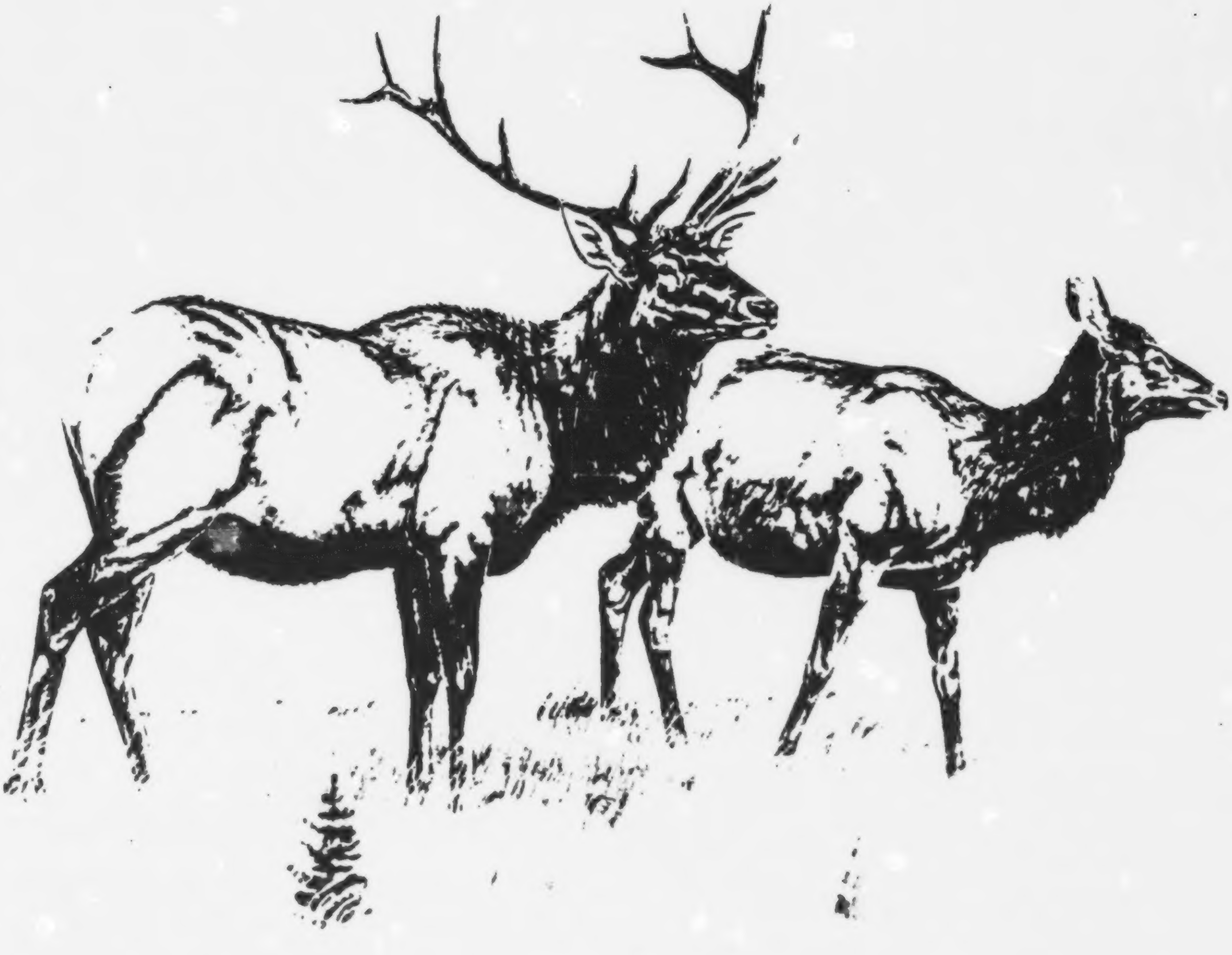


Figure 4: General Distribution of Habitat Quality for Moose in Alberta.

# ELK



# 5. KEY HABITAT REQUIREMENTS FOR ELK

## 5.1 General

Elk (Cervus elaphus) is a migratory species whose seasonal movements depend primarily upon vegetation availability in relation to snow depth. Forest edge and riparian vegetation associated with post-fire succession or logging provides excellent habitat for elk in both food and cover requirements. Valley bottoms are especially important for elk as travelways because of the elks' dependence upon the diverse vegetation species found in these unique areas. As well, proximity to sufficient hiding and thermal cover is available.

The distribution and relative quality of elk habitat in Alberta is depicted in Figure 5.

## 5.2 Cover

### 5.2.1 Vegetation

Closely stocked stands of coniferous forest, 12 m or greater with high stem densities and an average canopy closure exceeding 70 per cent, are used in winters characterized by very deep snow cover.[1,10]

Mixed-wood and deciduous forest, with trees less than 12 m in height and a canopy closure less than 70 per cent are used in spring, summer and mild winters.[1,10]

On spring-fall and summer ranges, the optimum size of stands for thermal cover is 12-24 ha, and for hiding cover is 2.6-10.5 ha.[1]

Well-developed shrub strata are preferred in winter but not in summer.[10]

Coniferous, mixed-wood and deciduous forests, with a well-developed understory capable of hiding 90 per cent of a standing elk from the view of a hunter at a distance of 61 m, provide effective hiding cover.[1]

Dense timber or heavy brush thickets are preferred sites for calving[10] though grassland-shrub. Shrub (> 1 m) communities are also used.

### 5.2.2 Land Forms and Topography

Elk prefer the upper third of valley slopes in winter; high alpine and subalpine terrain, especially ridge tops, are utilized in summer.

North-facing slopes are preferred in summer and fall; south-facing slopes in spring and winter.[10]

Elk prefer 15-30 per cent slopes, diminishing use at > 40-50 per cent and have little use at 90 per cent.[3,8] They prefer < 15 per cent slopes and dips in steeper slopes during calving.[1]

Small benches, basins, draws and stream and valley bottoms are used for calving sites.

Irregular and broken topography are important as visual barriers, particularly in non-forested areas.[1]

### 5.2.3 Climate

Warm, southern exposures and relatively low snow pack areas (< 0.5 m) are sought in winter and early spring.

Sites which are protected by topography or dense vegetation are often sought out during winter or early spring because these areas provide a refuge from strong winds, crusting or drifting snow.

Wind swept sites are preferred in summer to reduce harassment by insects.

## 5.3 Food

### 5.3.1 Vegetation

Grassland, parkland and shrubland cover types are most productive.

Grasses are preferred thoughout the year and are consumed in spring, summer and fall, as well as winter if available.

Poa sp. (bluegrass), Bromus sp. (brome), Agropyron sp. (wheatgrass), Melica sp. (melic grass), Festuca sp. (fescue) and Phleum sp. (timothy)[11] are preferred grasses.

Sedges (Carex sp.) are used extensively, particularly in the summer when they are green, but also in the fall and winter when the plants are brown and dried.[11]

Forbs are used in early and mid summer and fall.[7]

Deciduous shrubs and saplings are browsed mainly in late summer, fall and winter.[9] Saskatoon (Amelanchier alnifolia), water birch (Betula occidentalis) and aspen (Populus tremuloides) are all utilized proportionally greater than their availability, indicating preference. Other browse species consumed are willow (Salix sp.), rose (Rosa sp.), red osier dogwood (Cornus stolonifera), dwarf birch (Betula glandulosa) and low-bush cranberry (Viburnum edule).[11]

In agricultural areas cultivated crops may provide significant quantities of forage, particularly during the fall and winter.[6]

Open forage areas should be no wider than 366 m to allow close access to cover.[1]

### 5.3.2 Land Forms and Topography

Valley bottom floodplains and drainages with fertile soils have high food productivity and diversity.

North-facing slopes in summer and fall provide high quality forage; south-facing slopes in spring and winter are first to be snow-free and give access to forage.[10]

### 5.3.3 Aquatic Forms

Riparian and wetland zones are very productive of palatable forage.[1]

Elk prefer habitats within 0.8 km of permanent water,[1] primarily lower perennial rivers and streams.

### 5.3.4 Climate

Snow-free areas associated with southerly aspects and periodic chinook weather provide the greatest access to forage in winter and spring.[4]

Snow depth limits forage availability in winter, and at depths $> 61$ cm, browsing will replace grazing.[10]

### 5.3.5 Trace Elements

Elk are attracted to salt licks but they can do well in their absence on suitable soil types.[10]

## 5.4 Space

### 5.4.1 Territory/Home Range

Migratory elk herds generally are found in mountainous regions where they may move vertically in response to seasonal changes.[10]

In the same region some herds may migrate while others do not.[10]

In Wyoming, the distance travelled between summer and winter range varies from 32-97 km.[8]

### 5.4.2 Seasonal Population Densities

Densities of elk are $< 28.5/\text{km}^2$ on alpine ranges in summer, and for brief periods may be $> 180/\text{km}^2$ on winter ranges at Ya-Ha-Tinda Ranch along the upper Red Deer River.

## 5.5 Special Considerations

### 5.5.1 Size, Shape and Juxtaposition of Habitat Components

Valley and riparian habitats are important as travel corridors between high elevation summer range and low elevation winter range;[10] stringer forest stands also provide protected travel lanes.[1]

The most productive foraging areas are in the open or under fairly open canopies since herbaceous understory forage varies inversely with overstory.[10]

A good interspersion and juxtaposition of food and cover components is important and is provided by irregular topography and parkland or forest/meadow vegetation cover.[1]

Winter ranges are characterized by a high percentage of grassland; the largest wintering area in Alberta, near Bob's Creek, consists of 70 per cent grassland and 30 per cent forest.

Edge or ecotonal areas are high quality elk habitat because they provide great abundance and diveristy of forage with close proximity to cover.[10]

Most use by elk occurs within 183 m of the edge between cover and forage areas.[1]

Ecotonal areas are preferred sites for calving grounds.[10]

### 5.5.2 Significance of Disturbance Phenomena

Fire. Fire encourages the development of edge habitat and recently burned areas are often very productive of preferred forage species on otherwise forested lands.[10]

Fire control permits an increased survival of seedling trees producing overstocked tree stands. When the timber stands mature, the closed canopies cause a reduction of understory forage supplies.[10]

Control of wildfire also causes a decrease in edge.[10]

Logging. Logging puts much of the forest accessible at present (used by elk for summer range) in different stages of succession, providing a constant supply of ecotones and forage areas.[10]

Clearcut logging increases forage production and species diversity, but if the distance to available cover is too great these forage areas will not be used.[5]

Roads created for logging have provided greater accessibility to recreationalists and result in a greater need for available escape cover.[10]

Small amounts of logging slash can be used for hiding and calving cover, but if the depth of slash becomes greater than 2 m, the area becomes unsuitable for these purposes.[1]

Agriculture. Cultivation of land for agriculture may provide elk with food in fall and winter but it generally limits elk range.[10]

Livestock that share range with elk may not be in direct competition for the same forage species[2] but they may alter the native plant composition so that preferred forage species are reduced.[10]

The presence of cattle discourages elk use of common water sources and is usually associated with increased human disturbance.

## 5.6 Limiting Factors

Snow depth is the factor most limiting to elk movement and distribution in the province. Depths of 46 cm begin to restrict elk movement while depths > 76 cm seriously curtail elk escape and foraging opportunities.[10]

Elk are frequently precluded from utilizing areas where there is continual disturbance due to human activity (hunting, clearcut logging, snowmobiling etc.).[8]

Blocks of continuous habitat in excess of 1 000 ha which are relatively free from human disturbance are required to maintain a year-round resident population.[7]

Elk show a decreased use of areas adjacent to roads for distances ranging from 0.4-0.8 km.[1]

## 5.7 Regional Variations

Elk in the boreal mixed-wood rely more heavily on browse particularly during the winter. This is in contrast to the boreal foothills and mountain regions where semi-open and broken forest cover provide accessible grassland foraging areas at most times of the year.

## ACKNOWLEDGMENTS

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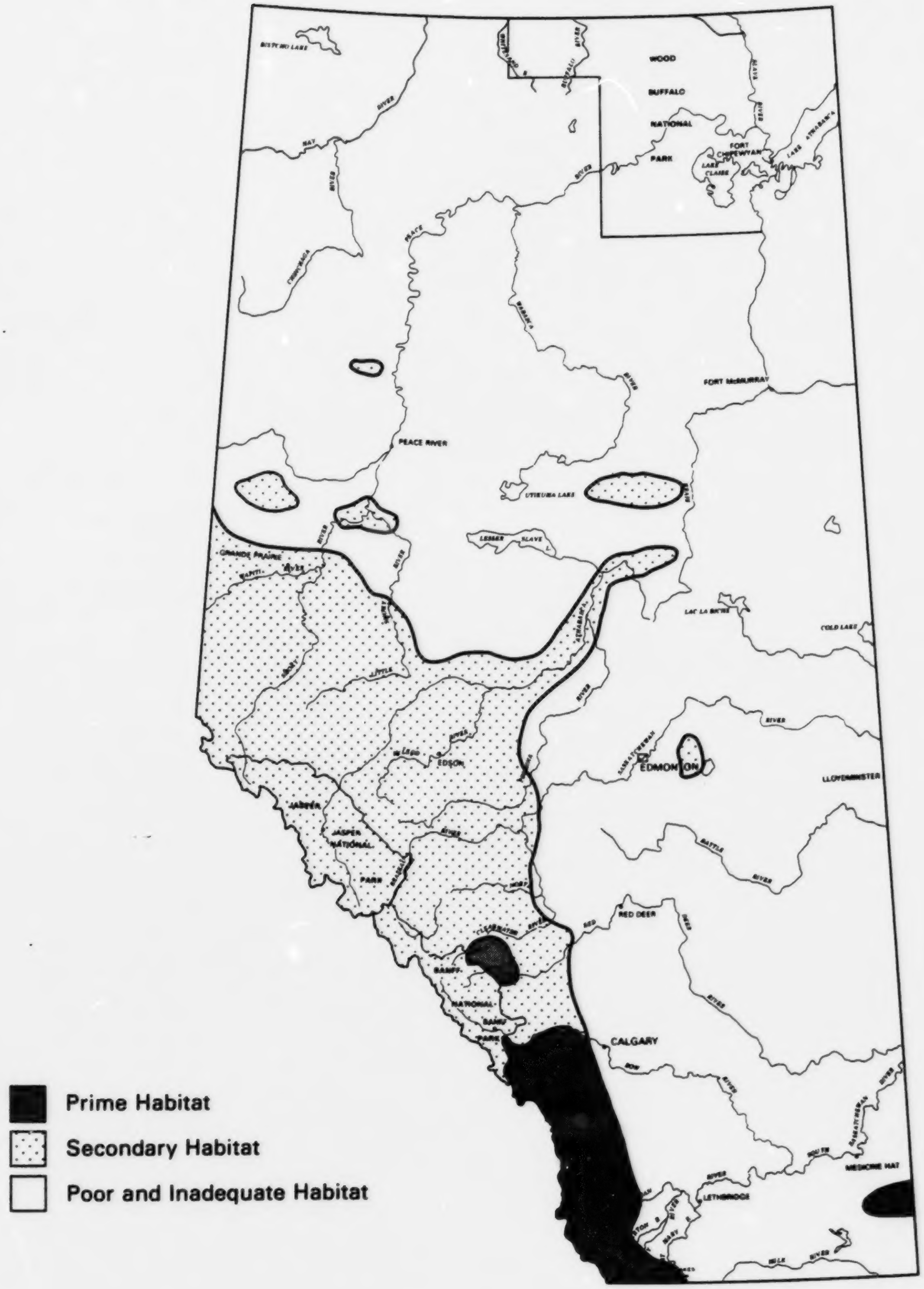
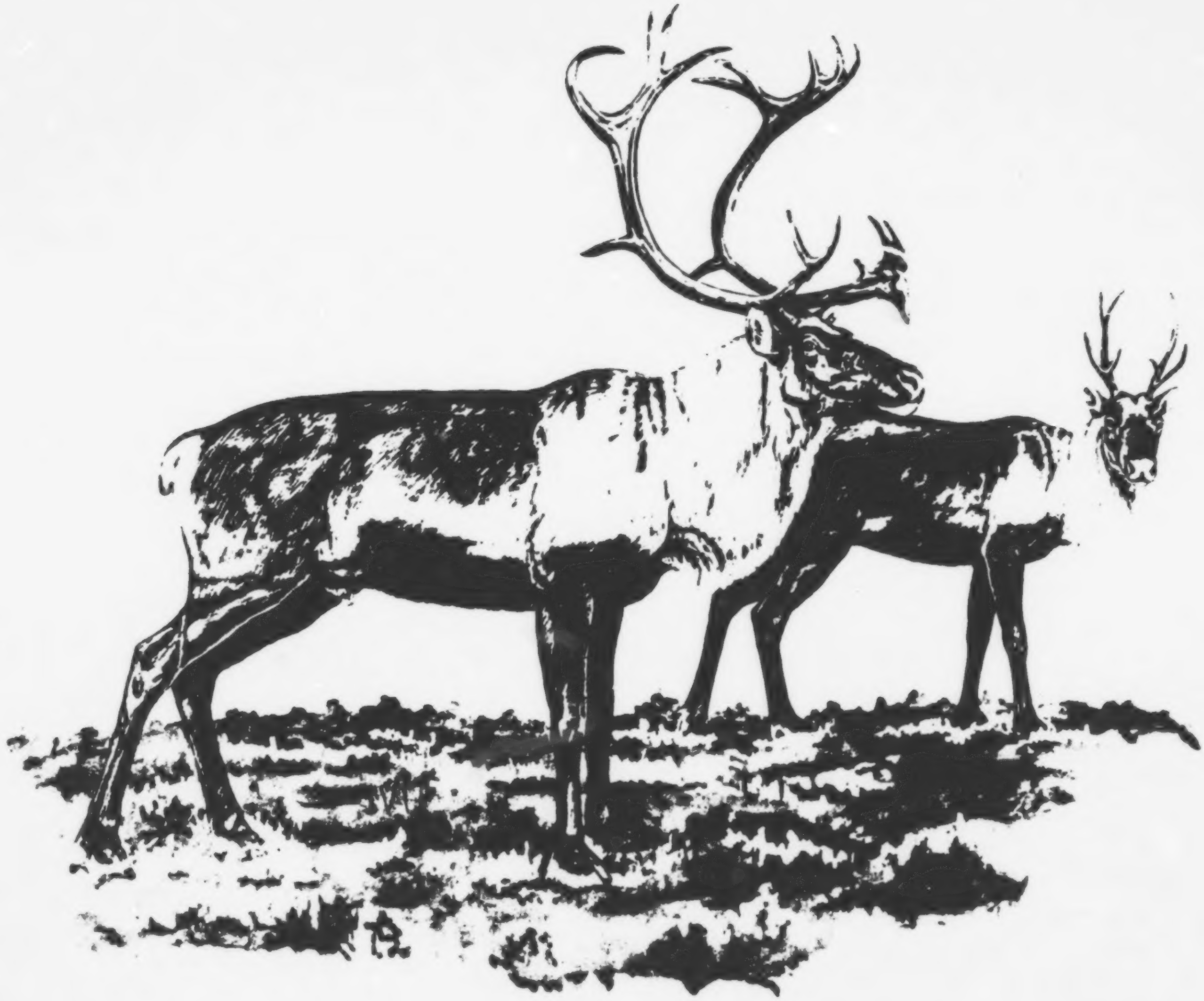


Figure 5: General Distribution of Habitat Quality for Elk in Alberta.

# CARIBOU



## 6. KEY HABITAT REQUIREMENTS FOR WOODLAND/MOUNTAIN CARIBOU

### 6.1 General

Woodland caribou (Rangifer tarandus caribou) is a climax forest species closely associated with the coniferous boreal zones. Throughout Alberta's northern region, woodland caribou use remote forested lands which produces an abundant supply of arboreal lichens and are in close proximity to muskeg.[8] Mountain caribou winter in forested areas but spend summer on open alpine sites. Caribou show much variation in use of habitat components from region to region.

The distribution and relative quality of caribou habitat in Alberta is depicted in Figure 6.

### 6.2 Cover

#### 6.2.1 Vegetation

Woodland caribou require extensive areas of mature coniferous forest during all seasons.[4] Mixed-wood forest may be sufficient under certain conditions, i.e. when there is no competition from other ungulates. Mountain caribou winter in forested habitat but spend summer in alpine regions.

In winter, caribou are associated with unevenly-aged climax stands, especially jackpine/lodgepole pine (Pinus banksiana/Pinus contorta) and spruce/tamarack muskegs (Picea sp./Larix laricina).[5]

In northeastern Alberta and the Peace River district, black-spruce (Picea mariana) muskegs were occupied most heavily at all times whereas aspen (Populus tremuloides) or aspen-conifer mixes were seldom used;[7],[8] in summer jackpine ridges are also used.[8]

Protective cover is important on migration routes and ideally should be 400 m wide.[3]

Stands of 400 m diameter are optimal for wintering areas.[3]

There is considerable variation in areas used as calving and breeding sites. Mountain caribou usually calve in untreed alpine areas while woodland caribou tend to utilize open muskeg sites with close proximity to forest cover.[5]

#### 6.2.2 Land Forms and Topography

In northeastern Alberta, fairly level lowlands appeared to be selected in all months.[7]

In mountainous regions, glaciers, snowfields and windy ridges are important for relief from summer heat and insect harassment.[11]

## 6.3 Food

### 6.3.1 Vegetation

Caribou use forested habitat year-round, feeding mainly on terrestrial and arboreal lichens in winter and on a variety of vascular plants in summer.[4]

Terrestrial lichens are the main winter forage, however arboreal lichens increase in importance in winters of deep snow and in late winter when snow crusting develops. Lichen/grass meadows and south-facing meadow slopes are used when snow depth or hardness is suitable.[5]

Arboreal lichen development is best in cool, humid coniferous forests, particularly in moderately stocked stands greater than 100 years old.[5]

In spring, caribou paw for shoots of herbs, mosses, lichens and fungi. In the summer they eat leaves of deciduous shrubs, forbs and herbs, lichens, grasses and sedges, and some aquatic plants.[4]

### 6.3.2 Land Forms and Topography

As winter progresses, accompanied by increasing snow depths, caribou increase use of upland areas where snow is soft and more shallow, and the availability of lichens is possibly greater.[7,9]

Use of lowland areas, especially open muskegs, occurs as snow disappears in early spring and new growth appears.[7]

Ridges provide avenues of travel.[6]

### 6.3.3 Aquatic Forms

Wetlands, muskegs and lake shores provide caribou with a rich and abundant summer diet. When frozen in the winter these aquatic forms are frequently used as travel corridors.

### 6.3.4 Climate

Woodland caribou are adapted for a cold climate and are very tolerant to snow depth. In Alberta, caribou movements are rarely restricted by snow, but deep snow does limit the availability of terrestrial lichens forcing them to utilize arboreal lichens.

## 6.4 Space

### 6.4.1 Territory/Home Range

Caribou require large, flexible ranges. Seasonal movements are dictated by food supply, suitable calving and breeding areas, and rotation of winter range to allow the slow regeneration of lichens.[5]

Mountain caribou generally make seasonal altitudinal movements from summer range in open alpine areas to winter forested areas at lower elevations.

### 6.4.2 Population Densities

In general, densities are low throughout the caribou range in Alberta with the highest densities occurring on late winter ranges and breeding grounds.

In the Berland area, overall annual densities for woodland caribou are 1/83 $km^2$, and 1/48 $km^2$ for mountain caribou. Winter densities are 1/27 $km^2$ for both subspecies.[5]

In the Birch mountains of northeastern Alberta 1 animal/24 $km^2$ is an estimate of the density on late winter range; the adjusted average annual density is 1/32 $km^2$.[7]

## 6.5 Special Considerations

### 6.5.1 Significance of Disturbance Phenomena

Fire. Fire removes climax forest essential to caribou for cover and the production of lichens for food.[2]

In Alberta, where fire suppression has been in effect for many decades, extensive fires can be a significant threat to existing caribou populations.

Caribou avoid recently burned areas which affect their movements and fragments their range.[10]

Fire creates evenly-aged stands and it might take centuries for the even-aged climax forest essential to sustained caribou populations to be reestablished.

In a recent burn, snow depths are higher because fire removes windbreak vegetation and a canopy that traps snow.[10]

Logging. Conventional, clearcut timber harvesting removes large tracts of mature and valuable lichen-producing forests[3], eliminating wintering habitat.

Clearcut logging methods also create barriers to movement, range discontinuity and increased human access.[3]

Agriculture. Clearing of land and drainage of swampy lowlands removes the key habitat components required for caribou.[5]

Human Disturbance. Roads through caribou habitat create disturbance and also provide greater accessibility to hunters and recreationists.[3]

Woodland caribou are more vulnerable to hunting than any other North American cervid.[1]

It is most important to minimize disturbance along travel corridors, critical late winter range, mineral licks, calving sites and breeding locations.[3]

## 6.6 Limiting Factors

Caribou require extensive areas of mature coniferous forest for cover and lichen production.

Disease and parasites are rarely a limiting factor. However predation, primarily wolves, can have a severe impact on recruitment in a population.

Initial human disturbance in caribou range tends to restrict caribou activity, i.e. abandonment of critical range, barriers to movement, loss of access to calving grounds, etc.

Caribou possess the lowest productivity of the deer family and therefore are slow to recover from population declines.

## ACKNOWLEDGMENTS

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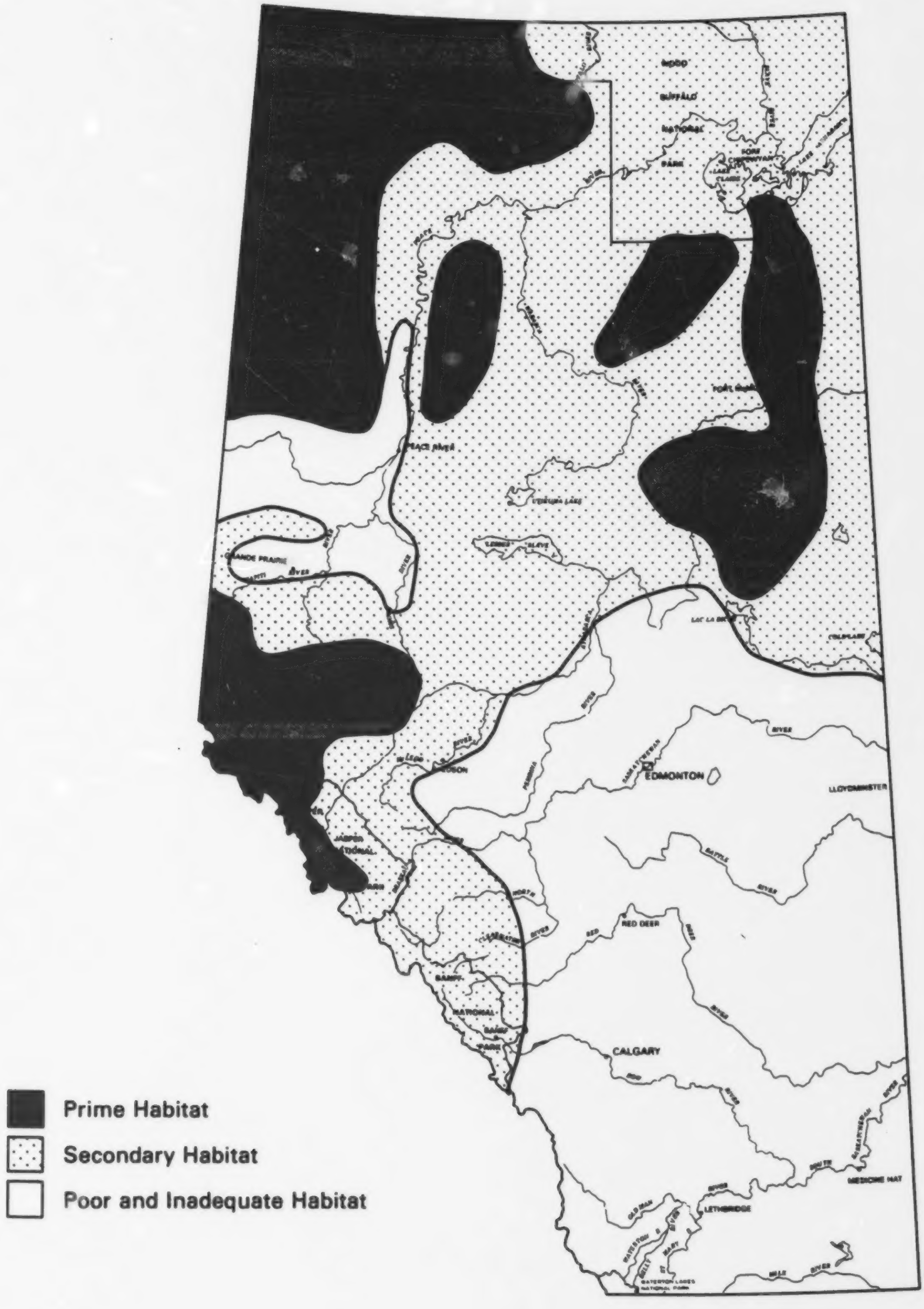

Figure 6: General Distribution of Habitat Quality for Caribou in Alberta.

# PRONGHORN ANTELOPE

# 7. KEY HABITAT REQUIREMENTS FOR PRONGHORN ANTELOPE

## 7.1 General

Pronghorn (Antilocapra americana) are restricted to the grassland region, the northern limit of their North American range. Highest antelope densities are found where suitable range, forage, cover requirements, water and abrupt topography occur in juxtaposition.[15] Pronghorns are closely associated with sagebrush (Artemisia cana) during winter months, as it is an important source of both food and cover.[5] Pronghorn antelope are sensitive to the conversion of native grassland to cultivated crops, and highest densities are found mainly where such disturbance is minimal.

The distribution and relative quality of pronghorn habitat is depicted in Figure 7.

## 7.2 Cover

### 7.2.1 Vegetation

During all seasons of the year, approximately 85-90 per cent of pronghorns are distributed on native grassland and native grassland/sagebrush cover.[5]

During summer, 70 per cent of pronghorns use native grassland prairie with no shrub cover; in winter, > 40 per cent of pronghorns range on grassland with heavy sagebrush.[5]

Low vegetative structure (averaging 40 cm high) is preferred; vegetation > 60 cm is used less because of reduced visibility and decreased mobility.[12]

Silver sagebrush and areas of grasses or forbs > 25 cm high provide the most successful fawning sites.[2]

Fawn bedding sites in Alberta had mean canopy coverage of 2.3 per cent shrubs, 10 per cent forbs and 87.7 per cent grass and sedges.[16]

### 7.2.2 Land Forms and Topography

Pronghorns most often use land forms typified by low rolling, open terrain. They are seldom found on slopes exceeding 30 percent.[18]

Local hilly areas, pre- and post-glacial meltwater channels and eroded coulees associated with major river channels all provide protective cover for antelope.

Slopes or crests of hills are common fawning areas; some fawns bed in small depressions on slopes or flat land.[3]

Slough bottoms are important summer habitat use areas.

### 7.2.3 Climate

A warm chinook wind, which periodically reduces or eliminates snow cover during winter, is the most important climatic event enabling pronghorns to survive in Alberta.

During very occasional cold winters with deep snow in southern Alberta, pronghorns were observed to utilize silverberry (Elaeagnus commutata), quaking aspen (Populus tremuloides) and willow (Salix sp.) as cover. Upper river breaks, summerfallow or harvested fields were occupied by most animals since wind action resulted in less snow in these areas.[4]

## 7.3 Food

### 7.3.1 Vegetation

Pronghorns consume a variety of plants with the largest percentage volume recorded: grasses and sedges (Carex sp.) (13 per cent), silver sagebrush (Artemsia cana) (29 per cent), and pasture sage (Artemsia frigida) (26 per cent). These species comprised over 65 per cent of the diet during the eight-month September-April period and accounted for more than 50 per cent of the total food consumed in all months except June, July and August.[15]

The winter diet is frequently made up of 75 per cent browse, predominantly sagebrush. Sagebrush is extensively used because of its availability and palatability.[15]

There is a marked increase in use of grass and sedges in spring which coincides with new growth.[15] Use of improved pasture planted to crested wheat grass (Agropyron cristatum) is high at this time of year.

The pronghorns' summer diet was characterized by a decreased use of grasses and sedges and an increased consumption of forbs and browse plants. Preferred forb species include: pasture sage, wild tomato (Solanum triflorum), doorweed (Polygonum aviculare), yellow goat's beard (Tragopogon dubius), butterfly-weed (Gaura coccinea), Colorado rubber-plant (Hymenoxys richardsonii), golden aster (Chrysopsis villosa) and wooly yarrow (Achillea millefolium), while silver sagebrush is the most important browse species.[15]

Cacti is utilized in late summer and fall.

In the fall, browse plants, especially silver sagebrush, are highly preferred and comprise the largest proportion of the diet; crops, especially winter wheat (Triticum sp.) and alfalfa (Medicano sativa), are also used.[15]

Preferred late summer and fall food items have a relatively high moisture content.

### 7.3.2 Aquatic Forms

Antelope require free water distributed at 1.5-8.0 km intervals during all seasons of the year.[12]

Fawns bed at a mean distance of 586 ± 30 m from water.[3]

Irrigation ditches, springs, streams, lakes, sloughs and snow, all meet water requirements.

### 7.3.3 Climate

Frequent chinooks greatly enhance winter forage availability.

Antelope have difficulty obtaining the necessary quality and quantity of forage if snow depth exceeds 25-30 cm.[18]

### 7.3.4 Trace Elements

A deficiency of trace minerals, especially selenium, can lower the survival rate of fawns and result in poor health of adults.[17]

## 7.4 Space

### 7.4.1 Territory/Home Range

Pronghorns often range over an area not exceeding 250-500 ha in season[6,10,13] but will make extensive movements from summer to winter ranges in response to snow depth and food availability.

Summer ranges may extend 96 km from winter range.

When undisturbed, the daily summer range of pronghorns in Wyoming was 16-65 ha;[10] in Montana pronghorns moved average daily distances of approximately 3.5 - 4.0 km.[7]

Pronghorns are most widely and evenly spaced during the spring fawning period.

Winter ranges should not exceed 37 pronghorn days per ha.[1]

### 7.4.2 Population Density

The mean density of pronghorn antelope in the grassland region during summer is 0.7/km$^2$ (1972-1982).[11]

Mean fall densities were 1.2 antelope per linear mile.[8] Similar numbers of animals were utilizing cultivated lands (47 per cent) and grasslands (44 per cent).

## 7.5 Special Considerations

### 7.5.1 Size, Shape and Juxtaposition of Habitat Components

Preferred winter ranges contain an average of 88 per cent native vegetation consisting primarily of grasslands with varying densities of silver sagebrush cover.

The optimum vegetative composition is 40-60 per cent grasses, 10-30 per cent forbs and 5-20 per cent browse.[19]

Cultivated lands may be used for food in the fall if within close proximity to native vegetative cover.

Important summer habitat is provided by slough bottoms and associated forb communities.[9]

### 7.5.2 Significance of Disturbance Phenomena

Agriculture. Pronghorns make some use of agricultural crops, preferably alfalfa and winter wheat during fall, but these are never a major component of their diet.

Improved pastures can provide important spring range.

Irrigation ditches may provide permanent or temporary water supplies for antelope.

Fences constructed to control livestock movements can be barriers to antelope movements.[12]

Fire. Pronghorns are well suited to sub-climax vegetation created by early spring fire; summer and fall fires may seriously retard regrowth.

Human Disturbance. In antelope habitat nearly all recreational vehicles create some harassment; disturbance is especially detrimental during fawning (May 15-June 15).[12]

Regular use of established roads produces minimal disturbance.

## 7.6 Limiting Factors

Pronghorns in Alberta are at the northern limit of their range in North America.

The extent and quality of winter range is the most limiting factor.
Antelope are restricted by snow greater than 25-30 cm therefore areas of low snowfall and frequent chinooks are critical to their survival.[11]

Antelope require sufficient cover for shelter in severe winter yet need open areas to allow visibility and mobility.

They are limited by large tracts of intensively cultivated land where protective cover and suitable forage is scarce and fences impede movements.

## ACKNOWLEDGMENTS

Critical review of the summary was provided by H. Vriend (Alberta Fish and Wildlife, Lethbridge).

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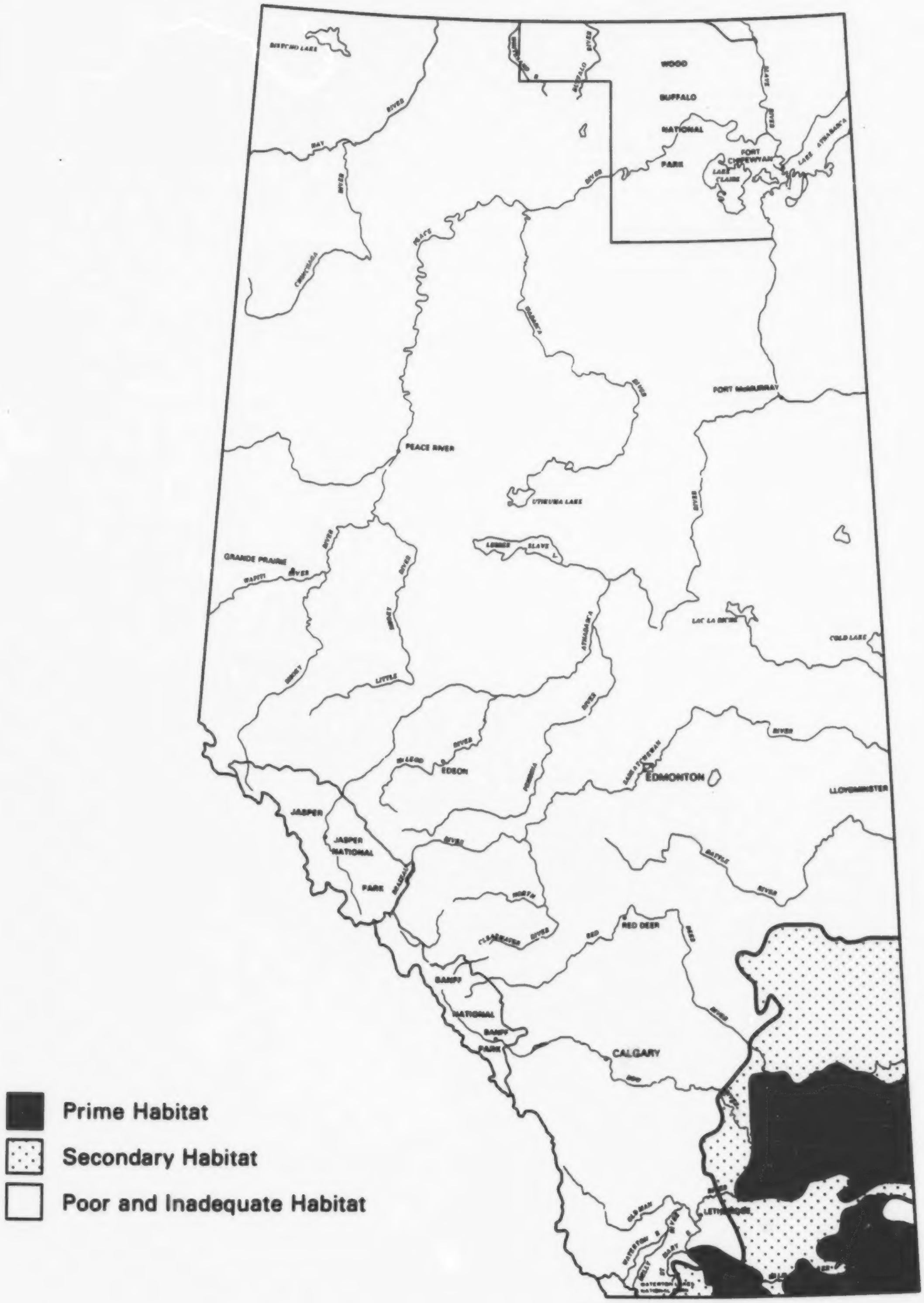
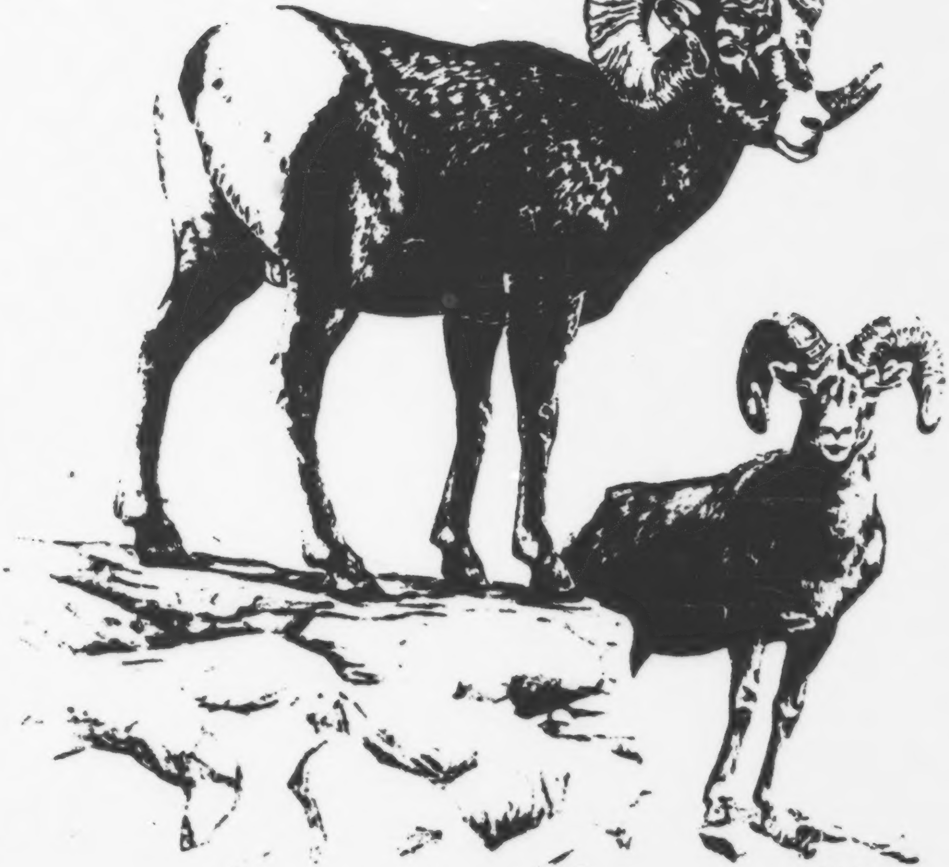


Figure 7: General Distribution of Habitat Quality for Pronghorn Antelope in Alberta.

# BIGHORN SHEEP



# 8. KEY HABITAT REQUIREMENTS FOR ROCKY MOUNTAIN BIGHORN SHEEP

## 8.1 General

Bighorn sheep (Ovis canadensis) inhabit the rugged mountains of the Eastern Slopes. They are generally restricted to semi-open grassy slopes adjacent to precipitous terrain with rocky slopes, ridges and cliffs. This terrain offers abundant forage, accessible escape cover and little competition from other ungulates.[7] Lungworm-pneumonia complex, along with adverse range and climate conditions, can dramatically decrease populations.[3,15] Sheep can be very sensitive to human disturbance, particularly hunting pressure.

The distribution of bighorn sheep habitat in Alberta is shown in Figure 8.

## 8.2 Cover

### 8.2.1 Vegetation

Bighorn sheep usually occupy areas with few trees, some low growing shrubs and either natural or burned grassland,[7] where visibility is unobstructed and escape terrain occurs nearby.[1]

Bighorn sheep avoid heavily timbered areas although they may temporarily seek shelter in treed stands in adverse weather or to escape predators.[7]

The most productive habitat is range that supports native plants.[20]

### 8.2.2 Land Forms and Topography

Sheep normally occupy rugged steep slopes in the range of 1 300-2 625 m elevation.[5]

During winter, preferred slopes have south or southwest exposures and are windswept with shallow snow.[11,14] Valleys, benches and old burns at low elevations are also preferred winter sites when adequate escape terrain is available nearby.[10,12]

During severe winter, if snow becomes crusted or deep, sheep will move to slightly higher elevations where wind and sun have cleared the more exposed slopes and ridges;[5] caves provide excellent shelter in adverse weather.[5]

Favorite bedding sites are usually along ridges or on high knolls from where predators can be readily detected. During the day, beds are made in the open near feeding sites while night beds are found in more rugged terrain.[7]

Preferred lambing range occurs on precipitous, secluded cliffs, near foraging areas[5,14] which generally are on dry, southern exposures.[5]

## 8.3 Food

### 8.3.1 Vegetation

Sheep are very specialized grazers which can live on hard, abrasive, dry plants,[7] although they prefer succulent grasses, sedges and forbs.[14]

They consume a wide variety of plant species and vegetation use throughout the year will depend on its availability.[8,11]

In summer, grasses are most important; forbs are more palatable but are only consumed when readily available.[18]

In winter, sheep paw through snow to obtain grass but if snow is too deep or crusted, they will browse; browse species are predominantly deciduous though conifers may be eaten.[18]

Some browsing occurs throughout the year.[14]

Preferred graminoids include sedge (*Carex* sp.), bluegrass (*Poa* sp.), wheatgrass (*Agropyron* sp.) and fescue (*Festuca* sp.); preferred browse species include sagebrush (*Artemisia cana*), willow (*Salix* sp.) and bitterbrush (*Purshia tridentata*).[14,18]

Food habits vary significantly with availability of forage species, season, climate and habitat sites.[18]

Optimum sheep range has a good mixture of grasses, forbs, and shrubs.[6]

Sheep populations may increase until winter ranges become overgrazed.[14]

### 8.3.2 Land Forms and Topography

In spring, sheep forage along south and east-facing slopes until they reach subalpine and alpine areas.[6]

The highest vegetated elevations above timberline, primarily grassland meadows and plateaus, are utilized in summer.[8]

During fall the sheep shift towards north-facing grasslands and semi-open forest where snow recedes last, and the vegetation is thus more succulent and nutritious.[16]

South and west-facing slopes are preferred in winter.[14,16]

Valley-bottoms and low elevation, south-facing slopes are evidently important to sheep in late pregnancy and early lactation as they provide high-protein forage.[16]

### 8.3.3 Aquatic Forms

Snow and succulent vegetation provide a year-round source of water for bighorn sheep[5,18] however, they often supplement this with open water.

Sheep can go for long periods without drinking.[8]

### 8.3.4 Climate

Climatic factors affecting the distribution of sheep, especially during winter, include snow depth, snow resistance, wind velocity and temperature.[16]

Sheep are not well adapted to deep and crusted snow, therefore they are forced to winter where snow is shallow (< 30 cm) and soft enough for them to forage.[8]

If strong winds sweep snow from cliffs and ridges the animals will extend their winter range to where foraging is easier.[5]

Extended drought is very detrimental to bighorn sheep range, especially if it is overgrazed as well.[3]

### 8.3.5 Trace Elements

Sheep are attracted to mineral licks particularly during spring and early summer[8] and may traverse long distances to reach them.[16]

It is unknown whether salt is a necessity or a desired supplement,[7] though it is suspected that potassium uptake from succulent forages may cause excessive sodium loss.[20]

Artificial salt causes lip irritations and contagious ecthyma.[9,15]

## 8.4 Space

### 8.4.1 Territory/Home Range

Generally, sheep have distinct, separate summer and winter ranges with corresponding spring and fall migrations.[7]

The migration is altitudinal with lower elevational ranges occupied in winter.

Distances of seasonal migrations vary from 8-60 km.[13]

Sheep migrate by following the best forage conditions, especially the green-up of succulent grasses and forbs in the spring.[6,7]

Sheep are predictable in their movements and loyal to their home ranges.[5] Sheep will deviate from an accustomed range usually only because of extreme habitat deterioration, or prolonged human disturbance.

Slope, distance to escape terrain, salt availability, elevation, depth and hardness of snow, aspect, forest cover, shrub production and biomass of grasses all affect local seasonal distributions.[7]

Minimum size for home ranges is about .8 km in diameter in midwinter, and the maximum is about 5.9 km in spring and fall.[5]

### 8.4.2 Population Density

On winter ranges in the Rocky Mountains densities range up to 19-23 sheep/km$^2$.[2]

## 8.5 Special Considerations

### 8.5.1 Size, Shape, and Juxtaposition of Habitat Components

The interspersion of grassland and alpine meadow areas with accessible escape terrain is important for suitable sheep habitat. Seasonal ranges connected by open habitat provide accessible migration routes.

Wintering ranges are often 1/10 the size of summer ranges[4], can be a part of a summer range or located some distance from it, and are located where snow accumulation is low (windswept ridge tops, steep south and west-facing slopes).[5,16]

### 8.5.2 Significance of Disturbance Phenomena

Fire is an important factor in range regeneration, a deterrent to forest encroachment on grass, and a possible aid in parasite control.[7]

Fire also eliminates elk escape cover thus reducing elk use on critical bighorn range.[7]

Selective logging does not contribute to bighorn habitat development, although clearcut logging can create additional range.

Livestock compete for forage especially on critical winter range.[19]

Sheep have a fear and aversion to cattle and may be forced on to less preferred habitat by their presence.[8]

Hunted sheep populations are disturbed by human activity; hiking, camping, recreational vehicles and road construction, etc., all place some degree of stress on the animals.[8,19]

It is especially important to minimize human activity along seasonal migration routes,[19] and on constricted winter ranges that often comprise 10 per cent of the yearlong range.[16]

## 8.6 Limiting Factors

Human activities and predation restrict sheep to rough, secluded terrain.

Exploration, development and recreation on or adjacent to critical sheep ranges may disturb sheep and result in range loss, or abandonment.

Predation somewhat restricts sheep movements, but does not prevent sheep numbers from exceeding range carrying capacity.[14]

Winter conditions, especially deep snow > 30 cm, restrict sheep mobility.[17]

Competition with livestock and with other wild ungulates (elk, mule deer) for range can be a major factor in their population densities.[8]

Parasites and diseases, particularly pneumonia and lungworms, also limit sheep numbers.[3,15] There is a definite relationship between disease-parasite burdens and winter forage supplies, stocking rates, winter weather and the duration of time sheep are exposed to overgrazed ranges heavily infested with parasites.[15]

ACKNOWLEDGMENTS

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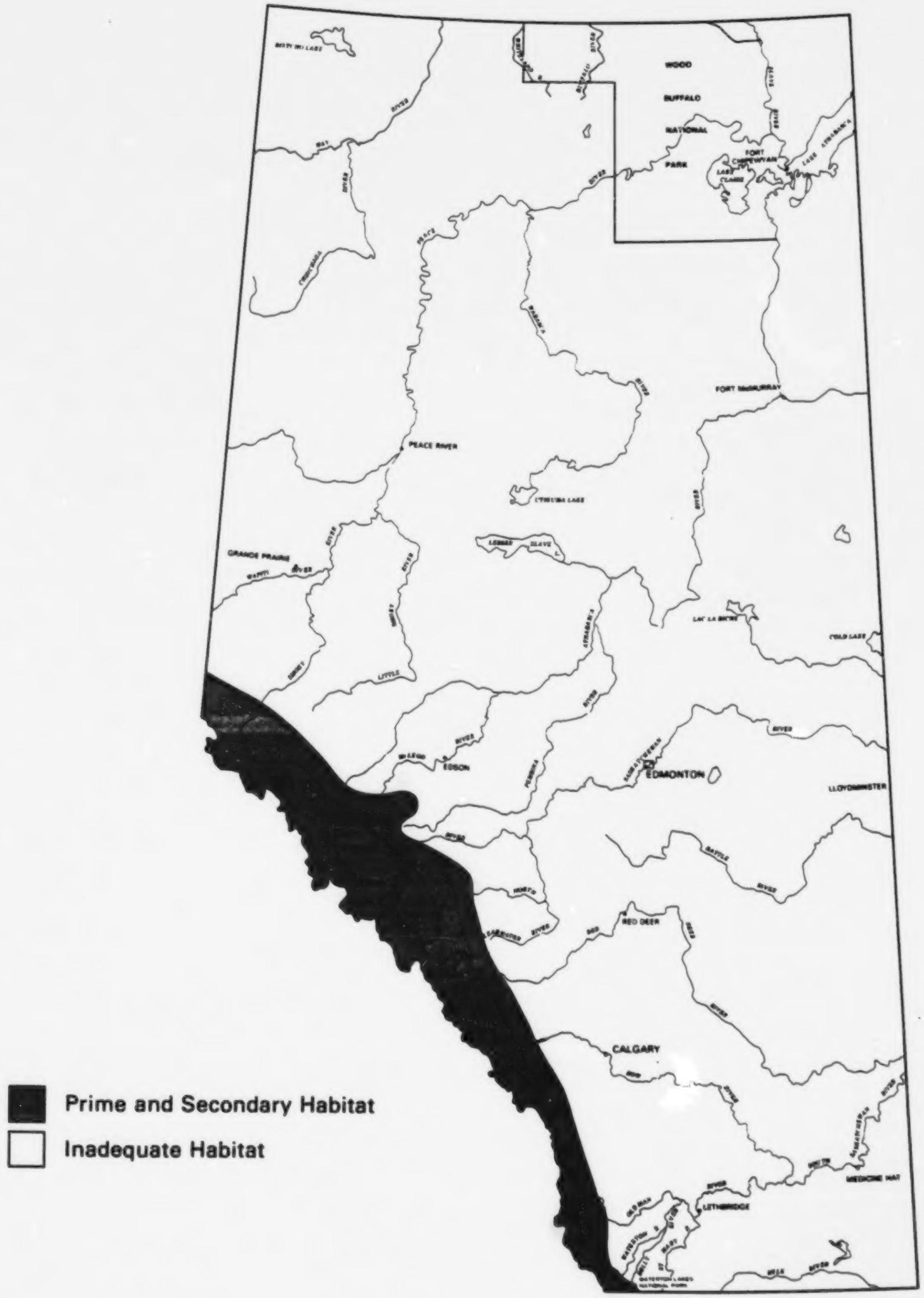

Figure 8: General Distribution of Habitat Quality for Bighorn Sheep in Alberta.

# MOUNTAIN GOAT

# 9. KEY HABITAT REQUIREMENTS FOR MOUNTAIN GOATS

## 9.1 General

Mountain goat (Oreamnos americanus) ranges are very localized within alpine tundra and subalpine areas of the Rocky Mountains. These areas are associated with low temperatures and heavy snowfall, thus lower elevation winter range with accessible food is critical to their survival. Goats prefer steep cliffs and slopes which are inaccessible to humans and other predators.[7]

The distribution of mountain goat habitat in Alberta is depicted in Figure 9.

## 9.2 Cover

### 9.2.1 Vegetation

In Colorado, alpine tundra including meadows and marshes, sparse conifers, and mountain shrubs are preferred cover. Areas with willows (Salix sp.), aspen (Populus tremuloides) and dense conifers that accumulate snow are avoided.[1]

Seventy-six per cent of goat herds in west-central Alberta were found on areas where shrubs and/or coniferous trees were present.[8]

The greatest use of forested areas in Montana occurred during July, August and October.[10]

Unobstructed visibility is not an essential habitat requirement therefore secure habitats may be heavily forested.[6,14]

### 9.2.2 Land Forms and Topography

Goats are closely associated with steep, grassy alpine areas, talus slopes and precipitous, bed-rock faces which are relatively inaccessible.

They prefer steep slopes or cliffs which offer protection from predators.[11,13]

In the Grande Cache area, 50 per cent of the total goat observations occurred on rock-talus areas with most bedding and escape activity occurring within 400 m of these sites.[9]

Nearly 50 per cent of all observations occurred on areas with 45-50° slope.[5,9]

In summer months goats appear at elevations greater than 2 250 m; goats are found at lower levels in winter.[10]

In Alberta, goats below treeline selected steep, south-facing slopes which are the first to lose snow[1] (as was also found in Colorado and Alaska [7]); above treeline, windswept ridges and north-facing slopes are utilized.

### 9.2.3 Climate

During severe weather, caves, overhanging ledges and the sheltered side of cliffs provide refuge.[15]

During cold winters with deep snow, goats use lower elevations and more southerly exposures.[13]

Deep crusted snow on lower altitude ranges may cause goats to move above timberline.[7]

## 9.3 Food

### 9.3.1 Vegetation

Preferred habitats of mountain goats generally have a low abundance of forage, requiring them to use a greater diversity of species to meet intake requirements.[4,2]

They consume a highly varied diet of alpine grasses and forbs as well as twigs and leaves of several trees and shrubs.

In Montana, grasses, sedges (*Carex* sp.) and rushes were most commonly eaten year round; coniferous trees were second in importance during winter and spring.[12]

During summer, goats in Alberta consume mostly grass and herbaceous vegetation.[3,9] In one study, willow made up approximately one quarter of the diet.[3]

Forbs were found to be important in summer diets in Alaska.[7]

Browse, especially coniferous, is the primary winter food of goats in west-central Alberta and grasses, herbs and forbs play minor roles.[8]

Major browse species are saskatoon (*Amelanchier alnifolia*) and silverberry (*Elaeagnus commutata*); secondary species include snowberry (*Symphoricarpos albus*), alder (*Alnus* sp.) and alpine fir (*Abies lasiocpara*); minor species include willow and wild gooseberry (*Ribes* sp.).[8]

Saskatoon is especially important because of its high palatability and availability.

Cliff terrain has forage which is often patchy and/or sparse so goats must forage alone or in small groups.[2]

### 9.3.2 Land Forms and Topography

Forage activity favors the better vegetated, relatively level, high elevation areas away from the rock-gravel cover types.[9]

During winter, sun and wind limit snow depths on south and west exposures where food availability is greatest.[11,16]

North and east-facing slopes have the greatest supply of snow, water and succulent forage in summer.[11]

### 9.3.3 Aquatic Forms

The presence of water does not affect the distribution of goats.[13]

In most ranges free water is not a significant limiting factor.[11]

Goats obtain most of their moisture from vegetation but have been seen eating snow year round at high altitudes; in most ranges, free water is usually only used periodically.

### 9.3.4 Climate

Goats can forage in relatively deep snow providing it is not heavily crusted.[4]

To avoid areas of deep or crusted snow they may migrate long distances to lower elevations and/or to areas where wind or aspect limit snow accumulation.[4]

### 9.3.5 Trace Element

Salt licks, to which goats frequently travel are used extensively, particularly in late summer and fall when sodium is low in their diet.[5]

Licks are heavily used when available but may not be a necessity except possibly where the soil is deficient in essential elements.[13]

## 9.4 Space

### 9.4.1 Territory/Home Range

Mountain goats tend to exist in small, isolated populations.[2]

They are relatively sedentary, occupying small home ranges.

Summer ranges can be widely dispersed, though winter ranges are more restricted.[7]

In winter, goats may merely concentrate on areas within or adjacent to their summer range.[2]

The mean summer range for males in Montana was 17.6 $km^2$ while their yearly range was 21.5 $km^2$; the mean summer range for females was 18.8 $km^2$, while their yearly range was 24.0 $km^2$; yearlings generally have larger home ranges.[10]

## 9.5 Special Considerations

### 9.5.1 Size, Shape and Juxtaposition of Habitat Components

Optimum habitat for mountain goats should contain quality forage areas well interspersed with escape terrain such as rocky cliffs.

On Colorado winter ranges, goats preferred areas without persistent or melt-crusted snow where cliffs were interspersed with tundra above treeline or with shrubs or sparse coniferous habitats below treeline.[1]

Usually goats winter on the highest south-facing cliffs available, where wind action is greatest, escape terrain is available, and both shrubs and conifers are present.

### 9.5.2 Significance of Disturbance Phenomena

Mountain goats tend to abandon areas undergoing logging activity;[10] most herds in Alberta, however, are located in protected areas ie. National Parks.

Road construction and traffic both disturb mountain goats.[10]

The existence of roads through goat ranges increases poaching and harassment by the public.[10]

## 9.6 Limiting Factors

The distribution of mountain goats lacks a predictable pattern.

Some ranges are well populated while others are completely ignored. The factors regulating preference for certain areas are not fully understood but include suitable forage, character of the topography and slope exposure.

Because good winter range for goats is scarce, it is the habitat feature most limiting their distribution; their survival depends on the availability of low elevation range where snow depths are not > 45 cm and forage is accessible.

During winters of below normal snow depths, vegetation composition, biomass and/or palatability play a larger role in habitat use.

Since goats live in relatively inaccessible terrain, predators (other than man) do not seriously restrict the population.

Reproductive success has been correlated with spring snow depth at high elevations.[2]

### ACKNOWLEDGMENTS

R. McFetridge, (Alberta Fish and Wildlife - Peace River) reviewed this summary.

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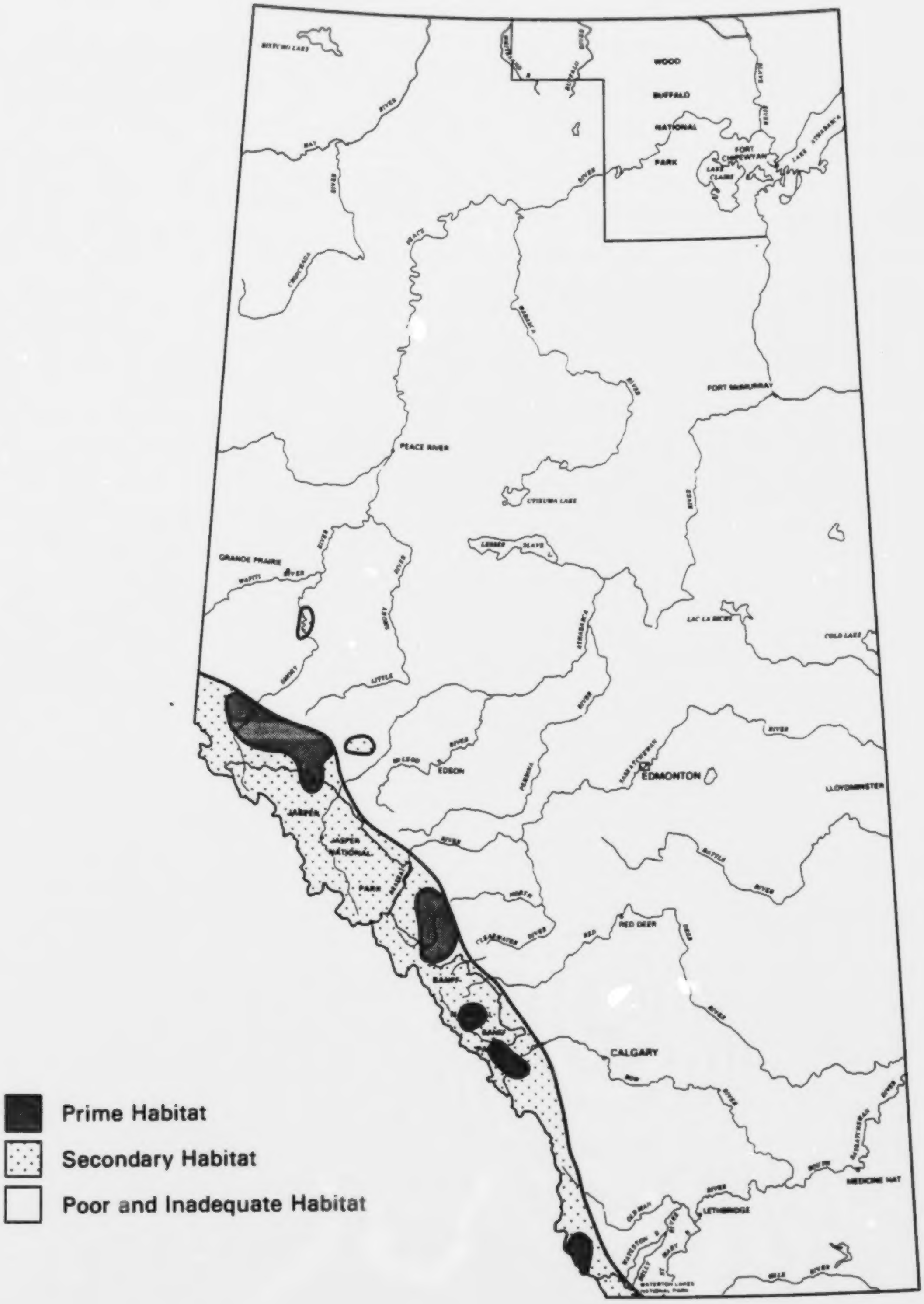

Figure 9: General Distribution of Habitat Quality for Mountain Goat in Alberta.

# GRIZZLY BEAR

# 10. KEY HABITAT REQUIREMENTS FOR GRIZZLY BEAR

## 10.1 General

The grizzly bear (Ursus arctos) is a highly mobile omnivore with large spatial requirements. It inhabits mainly subalpine and alpine regions, though it also occupies areas of the northern boreal forest and boreal-subalpine transitional forest in Alberta.[10,24] Grasslands and shrublands integrated with forests, subalpine meadows and forests, and alpine communities are typical grizzly habitat. Vegetative matter is the primary food source, though animal prey are taken opportunistically. Viable populations of grizzlies require areas of low human disturbance due to human-related bear mortality and the low reproductive potential of the grizzly.[6]

The distribution and relative quality of grizzly bear habitat in Alberta is shown in Figure 10.

## 10.2 Cover

### 10.2.1 Vegetation

In the foothills/mountainous regions, dominant cover includes lodgepole pine (Pinus contorta), spruce (Picea glauca x Picea engelmannii), subalpine fir (Abies lasiocarpa), alpine larch (Larix lyallii), willow (Salix sp.), dwarf birch (Betula glandulosa), buffalo berry (Shepherdia canadensis), shrublands, grasslands, subalpine and alpine meadows; seasonally important foraging areas include shrub fields, old burns, grasslands, meadows, riparian habitat, open woodlands and old cut blocks.[6,7,8,15,35]

In boreal and boreal mixed-wood areas, dominant cover includes lodgepole pine, white spruce, with aspen (Populus tremuloides) and black spruce (Picea mariana) as important constituents in some areas[1]; seasonally important foraging areas include shrub fields, old burns, grasslands riparian areas, open woodlands and old cut blocks.[35]

Security cover is most likely not a limiting factor in wilderness areas except in areas of resource development such as logging operations, and oil and gas exploration with associated road construction, all of which may increase hunting pressure.[19]

Adequate security cover to reduce visual contact by man is vegetation and/or topography which hides 90 per cent of a grizzly from view of a person 122 m away. Cover should have a diameter of at least 91 m.[35]

Alder (Alnus) thickets, lodgepole blowdown and other dense vegetation are preferred as bedding sites in Montana.[6]

Den sites vary in location from alpine/subalpine talus slopes, shrub-fields, knumholtz areas to variously-timbered subalpine and lowland areas.[34]

Surface vegetation covering den sites varies from grass and/or forbs to shrubs (willow, alder) or trees. Aerial vegetation acts as a snow catchment, while roots provide surface soil stability.[4,26,34]

### 10.2.2 Land Forms and Topography

Valley bottoms and ridgetops serve as travel corridors throughout home ranges.[31,36]

Summit ridges, with associated rock outcrops and rubble, served as mating areas in Banff.[9]

Though the exact combination of elevation, aspect, and soil type vary from one geographic area to another, most dens are located to ensure an early and long-lasting snow cover for insulation.[33]

Dens were found at an average altitude of 2 280 m asl in Banff,[30] and between 2 100-2 380 m asl in Jasper.[28]

Dens tend to be located on slopes allowing for ease of digging, mostly ranging from 25°-40°.[18,25,34]

Soil orders of dens in Banff consist of Podzolic, Brunisolic, Chernozemic and Regosolic.[34] These soils are well drained (prevent internal flooding of dens during late winter/early spring melts) and cohesive enough to maintain the physical stability of the den during the first winter.

No relationship was found between den sites and bedrock geology.[34]

No geographical/ecological differences were found between the denning sites of males and females.[26]

### 10.2.3 Aquatic Forms

River courses are used as corridors for movement.[31]

### 10.2.4 Climate

Low temperatures and snow influence the time grizzlies enter their dens.[4,11]

Den exposure may be related to prevailing wind/radiation patterns which determine area of snow accumulation and possible soil freeze-up.[4,25,29,22,23]

## 10.3 Food

### 10.3.1 Vegetation/Animal Matter

Grizzlies are omnivorous; they have high energy requirements but are physically, biologically and socially adapted to exploit a wide range of foods.[5]

The grizzly is primarily a herbivore and secondarily a carnivore.[17]

In spring, grizzlies feed on roots (mainly hedysarum, *Hedysarum* sp in Banff), green grasses, and bearberry (*Arctostaphylos uva-ursi*).[5,8,16,17,18,26,28]

Carrion from winter killed animals may also be an important food source upon den emergence.[2,23]

During the growing season, forbs such as horsetail (*Equisetum arvense*), cow parsnip (*Heracleum lanatum*), glacier lily corms (*Erythronium grandiflorum*), grasses and sedges (*Carex*), and other green vegetation are primary components in the diet.[5,8,16,17,18] Moist fens and streamsides produce high densities of prime summer vegetation.[16]

In late summer and fall, berries (huckleberry - *Vaccinium membranaceum*, blueberry - *V. myrtilloides*, buffaloberry, currants - *Ribes*, and saskatoons - *Amelanchier alnifolia*) are an important component of the diet.[5,8,17] Roots, grasses and forbs continue to be consumed, especially roots during fall.[8,16,17]

Animal matter such as ants, ground squirrels (*Spermophilus* spp.), and young, weak or old ungulates are taken opportunistically.[5,17,18,8,34]

When available, mammals are priority food items in Banff; scavenged or killed ungulates such as elk (*Cervus elaphus*) calves are common in the diet.[8]

Grizzlies locate and learn to use specific locales where plant food are abundant; the most productive sites become centres of activity within the home range.[6]

Within years, there are often seasonal concentrations of bears at feeding sites offering unlimited or abundant food supplies (e.g. berry patches).[33]

### 10.3.2 Land Forms and Topography

Ridgetops, talus slopes, snowchutes, creek/river bottoms, fluvial and alluvial flood plains, and river/stream sides are seasonally important foraging areas.[6,7,15,36,35]

Colluvial slopes are preferred digging areas for hedysarum roots in Banff.[8]

Anthropogenic sites such as reclaimed well sites, pipelines and road sites are also utilized seasonally.[19] Most of these sites are subject to frequent or recent disturbance and therefore support early succession vegetation forms.

### 10.3.3 Aquatic Forms

Riparian habitats (rivers, streams, creeks, fens, bogs and seeps) provide aquatic vegetation types such as sedges and horse-tails.[6,7,15,36,32]

### 10.3.4 Climate

Snow and frozen ground during the fall prehibernation period or upon spring emergence renders many food resources unavailable to bears, resulting in a negative energy balance until green-up occurs.[22,23]

## 10.4 Space

### 10.4.1 Territory/Home Range

The grizzly bear is a mobile, wide-ranging animal that establishes seasonal home ranges.[5]

Adult females exhibit behavior suggestive of territoriality.[25]

Home range sizes recorded in Alberta is boreal forest are 126 km$^2$ for males and 179 km$^2$ for females[20,27], Alberta Rocky Mountain ranges are 535 km$^2$ for males and 179 km$^2$ for females.[9,28] Adult males may range over 1 000 km$^2$.

Ranges vary greatly in area depending on the sex and age of the animal, seasonal and annual food availability, reproductive condition of females, as well as habitat type and population densities.[3,5,25]

Seasonal ranges may be widely separated and distributed by altitude.[25]

Males tend to have larger home ranges than females. Their ranges overlap extensively with both females and other males. Home ranges of females overlap each other, but not to the extent they overlap male ranges.[3,12,13,25,29,22,23]

Core areas represent the most intensively used sites within a home range. In Alaska, females depend on exclusive occupancy of feeding territories to breed.[29]

Home range sizes of females are related to reproductive status and age of young accompanying them.

In Banff, females decreased home range size when accompanied by young cubs, though they maintained a larger home range when with mobile offspring than when solitary.[9]

Females with offspring of the year generally occupy small areas in rugged terrain.

Offspring may range with the female for the first two-three years.[6]

### 10.4.2 Population Densities

Grizzly bear densities in the boreal forest region of Alberta are reported at 118 km$^2$/bear[21]; in mountainous habitat (Glacier National Park, B.C.), densities are 21.2 km$^2$/bear.[33]

## 10.5 Special Considerations

### 10.5.1 Size, Shape and Juxtaposition of Habitat Components

Grizzlies require relatively large wilderness areas, preferring high habitat diversity.[7,14]

Combinations of terrain and vegetation forming mosaics of forests, shrublands, grasslands and meadows, and riparian regions provide an interspersed array of habitats for the grizzly bear.[15]

Distribution of forests relative to grass-forb shrublands creates an edge-effect, enabling bears to feed on a variety of items within relatively small ranges.[6]

Seral plant communities are important feeding habitat.[8]

### 10.5.2 Significance of Disturbance Phenomena

Fire/Slides. Fire suppression may decrease available habitat by reducing the amount of open habitat types used for foraging.[7] It also reduces the availability of foraging areas for ungulates, thus reducing the availability of carrion and the potential for opportunistic kills.[19]

Wildfires, snowslides and rockslides provide habitat diversity within coniferous forests by maintaining seral shrub and conifer communities.[15]

Logging. Logging of mature timber stands may enhance attractiveness as bear habitat. Earlier successional stages provide an abundance of food.[7]

Selective cuts and untreated clearcuts produce forbs and fruit-bearing shrubs, attracting grizzly use.[36]

Clearcuts with extensive post-logging treatment reduce grizzly foods and cover[36].

Clearcuts should be irregularly shaped, small (<20 ha) with one or more leave patches <1 ha, minimum soil scarification (<20 per cent) and slash disposal by broadcast burning or no slash disposal.[36]

Timber removals increase access into areas and may result in displacement of bears due to disturbance, through removal of suitable habitat, or losses due to human-bear interactions.[21]

Human Disturbance. There is competition between people and grizzly bear for space and habitat.[6]

Recreation, petrochemical exploration and industrial development modify the habitat and increase accessibility, increasing the chance of human-bear interactions and exploitation of the grizzly by legal and illegal harvest.[1,6,20,26,30]

Artificial food sites (garbage dumps) affect dispersion and movement of the bear population, often concentrating bears for prolonged periods and may bring bears into close contact with people if placed near areas of human activity.[6,11]

Overhunting may result in loss or suppression of grizzly bear population.[24]

Recognition of the grizzly bear's niche can reduce conflict between humans and bears while allowing controlled development to occur.[8]

Agriculture. Conflicts between grizzlies and cattle have generally been associated with bear-caused deaths, resulting in termination or removal of bears from some grazing ranges.[32]

Cattle may compete for the forage resources of the grizzly.[36]

## 10.6 Limiting Factors

Wilderness, though not essential, is where grizzly bears do best.[8]

Grizzlies do adapt to the presence of humans, but cannot adapt to people's intensive use and modification of its habitat.[6]

Where grizzlies and people compete for the same habitat, people-caused bear deaths rise. The grizzly has a low reproductive rate which cannot offset heavy and persistent mortality.[6]

Preservation of especially high quality grizzly bear habitat in remote areas would reduce human-bear conflicts.[8]

Habitat quality limits the carrying capacity of an area for grizzlies.[19]

Failures in berry crops, an important prehibernation food, may reduce reproductive success.[19]

## 10.7 Regional Variation

Grizzly bear densities in mountainous habitat are much higher than those recorded for the boreal forest, suggesting higher habitat quality (food, diversity of habitat components, seclusion).

Prairie grasslands serve as a foraging area for grizzly bear from the Waterton Parks region.

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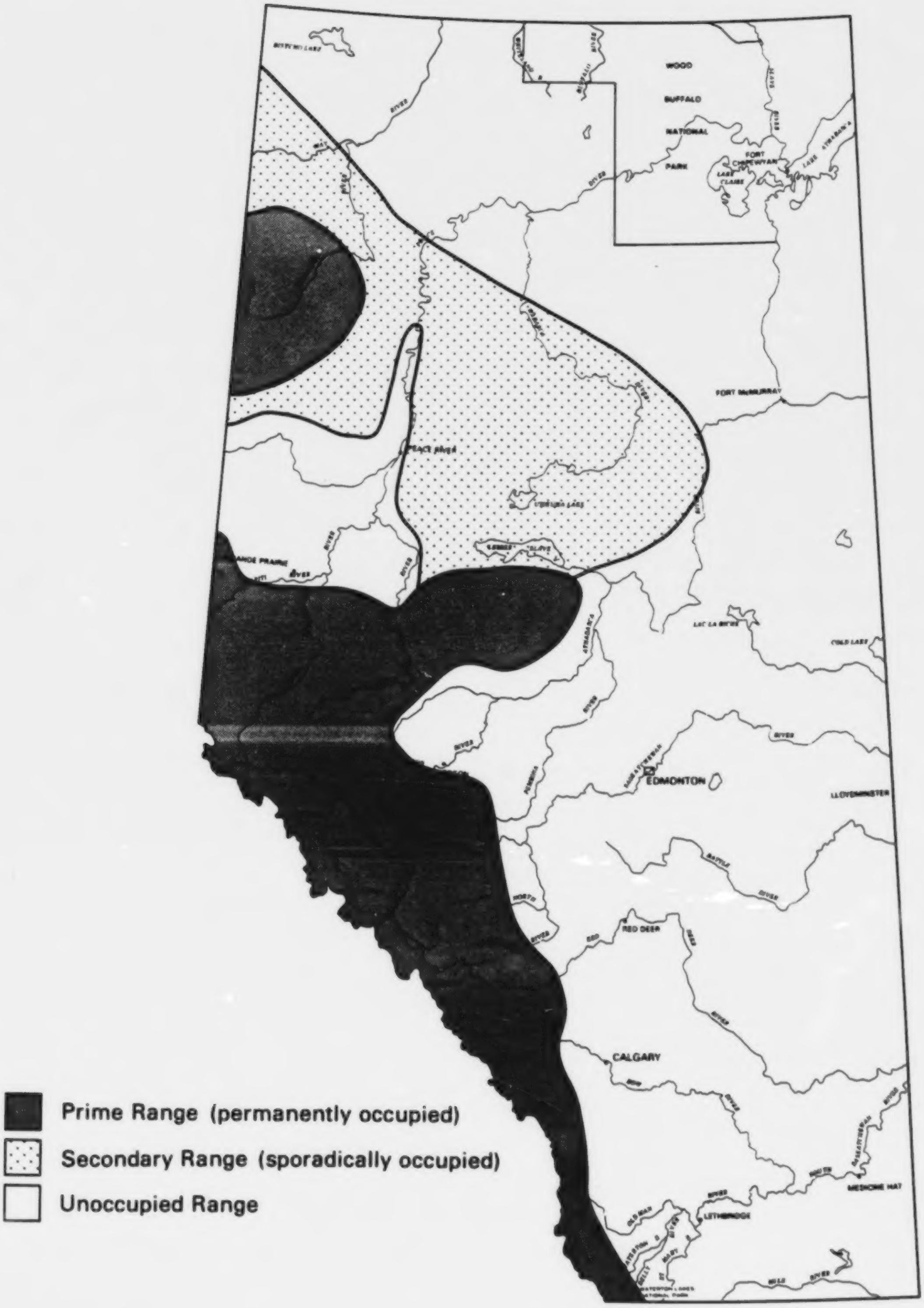

Figure 10: General Population Distribution for Grizzly Bear in Alberta.

# BEAVER

# 11. KEY HABITAT REQUIREMENTS FOR BEAVER

## 11.1 General

Water is the prerequisite of beaver habitat (Castor canadensis). This semi-aquatic furbearer can utilize a wide range of aquatic environments. Ideal habitat conditions are likely to be found where an adequately deep body of water (0.9-1.5 m minimum) occurs in association with stable, fine-textured shoreline substrata needed for lodge or bank den construction and abundant supplies of upland deciduous woody vegetation for food and lodge building. The beaver occupies a niche that is transitional between aquatic and terrestrial environments and therefore prefers high-density wetland and stream areas.

The distribution and relative quality of beaver habitat in Alberta is shown in Figure 11a. Distribution of beaver harvest is displayed in Figure 11b.

## 11.2 Cover

### 11.2.1 Vegetation

Aspen (Populus tremuloides) is the species most commonly used for building material; in its absence, beaver will rely on willow (Salix sp.).[1]

Alder (Alnus sp.) is another preferred construction material for lodges and dams and is frequently found in beaver food caches.[6]

Alder may also be used as a capping material for sinking preferred foods so they do not freeze into the ice.[4]

Although aspen and willow are most frequently cut by beaver, almost every woody plant is cut to some extent.[1]

### 11.2.2 Land Forms and Topography

Beavers require bank forms of sufficiently fine texture, with stability to support excavation (burrowing) or dam and lodge construction.[6]

Soils containing clay are best suited for construction; coarse sands and gravels are unsuitable[6]; shales are subject to faulting and slipping.[8]

V-shaped valleys are more subject to dam breakage than U-shaped valleys with broader flood plains and lower gradients.[7]

The majority of beaver colonies in Alberta are built in valleys with gradients of $< 2$ per cent. Dams tend not to be built on gradients $> 15°$.[8]

### 11.2.3 Aquatic Forms

A wide variety of aquatic environments can be utilized by beaver providing that they are of sufficient depth to accommodate bank dens or lodges and permit free movement from the dwelling to the food cache during winter.[6]

Throughout most beaver range in Alberta, minimum water depths required are 0.9-1.5 m.[6]

They prefer natural lakes or streams with seasonally stable water levels, or a watercourse whose level can be controlled by construction of dams. The most stable water level conditions are provided by low gradient meandering streams and rivers with flat bottomed U-shaped valleys.[6]

High densities of permanent wetlands, such as occur in strongly undulating and hummocky moraine areas, provide ideal habitat.[6]

Large lakes with convoluted shorelines and small sheltered bays provide good potential habitat and also reduce wave action and provide refuge.[6]

Deltas subject to large water level fluctuations and active erosion and deposition result in very poor beaver habitat.[3]

In northern regions, beaver utilize organic wetlands, thermokarst lakes, floodplain oxbows and stabilized deltaic areas because of their availability.[3]

### 11.2.4 Climate

The increasing severity of climatic conditions limits areas of suitable habitat.

Snow depth is the main factor regulating ice thickness,[3] and in harsh areas with cold temperatures and little snow, the greater ice depths will require deeper ponds.

Longer winter periods will require larger accessible food supplies.

## 11.3 Food

### 11.3.1 Vegetation

Deciduous trees and shrubs constitute the main source of food though herbaceous upland vegetation may also be utilized. Grain crops are sometimes used in spring and summer.[2,6]

Both aspen poplar and willow are heavily used by beaver, but aspen is the preferred food; balsam poplar (*Populus balsamifera*) and birch (*Betula* sp.) may be used depending on their availability.[6]

Aquatic herbaceous vegetation is important in the beaver's diet during the spring and summer months.[6]

Yellow pond-lily (*Nuphar variegatum*) rhizomes may be used by beaver year- round if they are available, especially in more northern organic wetland environments.[6]

Under stress of necessity, almost any type of deciduous species can be used for food;[2] black spruce (Picea mariana) has been found in food caches though it could be there for capping.

### 11.3.2 Land Forms and Topography

Steep slopes adjacent to suitable wetland areas restrict upland foraging.[6]

If the relief is shallow large tracts of vegetation will be covered by water as a result of damming, whereas in steep topography a smaller area will be accessible by damming water.[1]

### 11.3.3 Aquatic Forms

Aquatic and riparian communities assume primary importance in feeding.[6]

Meandering streams and rivers with cut-off channels and slow-flowing backwater areas provide beaver with an abundance of accessible food supplies, particularly willow, balsam poplar and water birch.

Small, intermittent streams are easily dammed if well defined, firm banks border the drainage, thus increasing the foraging area for beaver.

## 11.4 Space

### 11.4.1 Population Densities

Beaver densities in northern Alberta and southwestern portions of Northwest Territories range from 0-1 colonies per survey kilometre of streams or lake shoreline with an average density of 0.03 lodges per kilometre.[3,5]

Densities of over one active lodge per kilometre indicates a population of maximum density in the most favorable habitat in northern regions.[3]

Beaver densities are much higher in parklands where habitat conditions are optimum.

## 11.5 Special Considerations

### 11.5.1 Size, Shape and Juxtaposition of Habitat Components

The range of the beaver is remarkably similar to that of aspen and willow; beaver will occupy areas where aspen is absent but very few are found outside of the range of willow, leading some to believe that willow, not aspen, is the key plant in beaver habitat.[1]

Aspen stands are regarded as temporary use areas, because selective aspen cutting by beaver often hastens succession of the stand to a more advanced stage, whereas willow/alder stands may produce climax stands which can be cut on a sustained yield basis. Once a willow/alder population is exhausted, beaver will move to a new area.[1]

A high interspersion of land and water provides ideal beaver habitat; beaver will seldom forage more than 200 m from water and most cutting is done within 30 m of water.[6]

Wetland configurations which increase shoreline length relative to surface area generally provide a greater amount of potential habitat.[6]

### 11.5.2 Significance of Disturbance Phenomena

Agriculture. Each year there is a loss of beaver habitat due to the increase of cultivated land through draining wetlands and removing deciduous tree and shrub cover.

Fire. Small, local burns interrupt plant succession patterns and enhance beaver habitat since the pioneer woody species on burns are aspen and other deciduous trees and shrubs.

Large burns over entire watersheds may make the area very susceptible to flash flooding and erosion.[7]

The magnitude of the effect depends on the severity and extent of the fire, the rate of regeneration and the amount of subsequent erosion caused by the fire.[7]

Beaver populations are likely to be fully recovered 5-6 years after a large burn.

Flooding. Temporary, seasonal flooding adds organic nutrients to the system and enhances the growth of willow and the development of aquatic plants such as sedges (Carex sp.) and water lily (Nuphar). This may benefit the habitat initially, but flooding can be harmful if it occurs during winter freeze-up.

Human Disturbance. Drainage and decreased water levels resulting from human activities may increase the susceptibility of beaver to predation, and may cause the food cache to freeze in winter making it inaccessible.

The influx of sediment into standing water hastens the filling-in of the basin and also reduces the productivity of aquatic vegetation.

Beaver are a highly resilient species able to exist in close association with human activity.[7]

## 11.6 Significant Limiting Factors

Beaver are limited in distribution by the presence of aspen and willow for food and building materials and the occurrence of suitable bodies of water for protection, shelter and supplementary aquatic food sources.

Beaver are not greatly affected by human disturbance and show only limited negative response toward highways and pipeline operations except where channelization and siltation occur.

Very coarse-textured substrata limit damming capabilities and infertile substrata reduce food productivity.

Very flat topography limits the availability of suitably deep and permanent aquatic environments.

Steep-sloping topography restricts upland foraging.

Fast-flowing aquatic environments reduce vegetation productivity, restrict the ability of beaver to build dams and lodges and reduce the stability of aquatic cover.

Widely fluctuating water levels reduce dam and lodge construction capabilities and may cause freezing of the food cache during winter.

## 11.7 Regional Variations

In the northern boreal mixed-wood, willow is the predominant species of beaver habitat because aspen occurs only in small islands and rarely at water's edge.[3]

Aspen does occur along the Peace and Athabasca River valleys and is utilized more in these areas.[3]

In agricultural areas where natural water and food requirements may not be present, beaver will inhabit dugouts and utilize grain crops as part of their diet.

## ACKNOWLEDGMENTS

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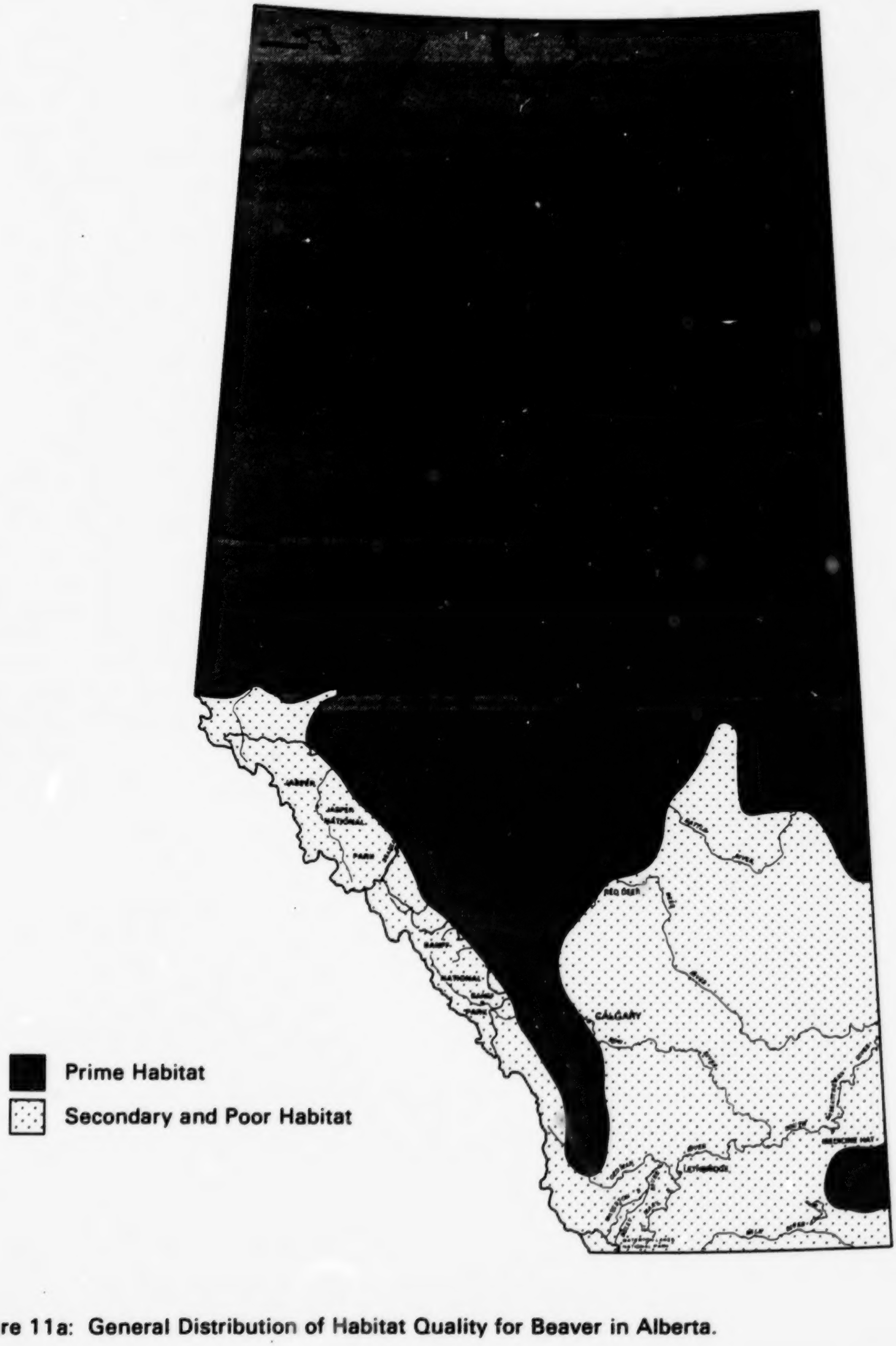

Figure 11a: General Distribution of Habitat Quality for Beaver in Alberta.

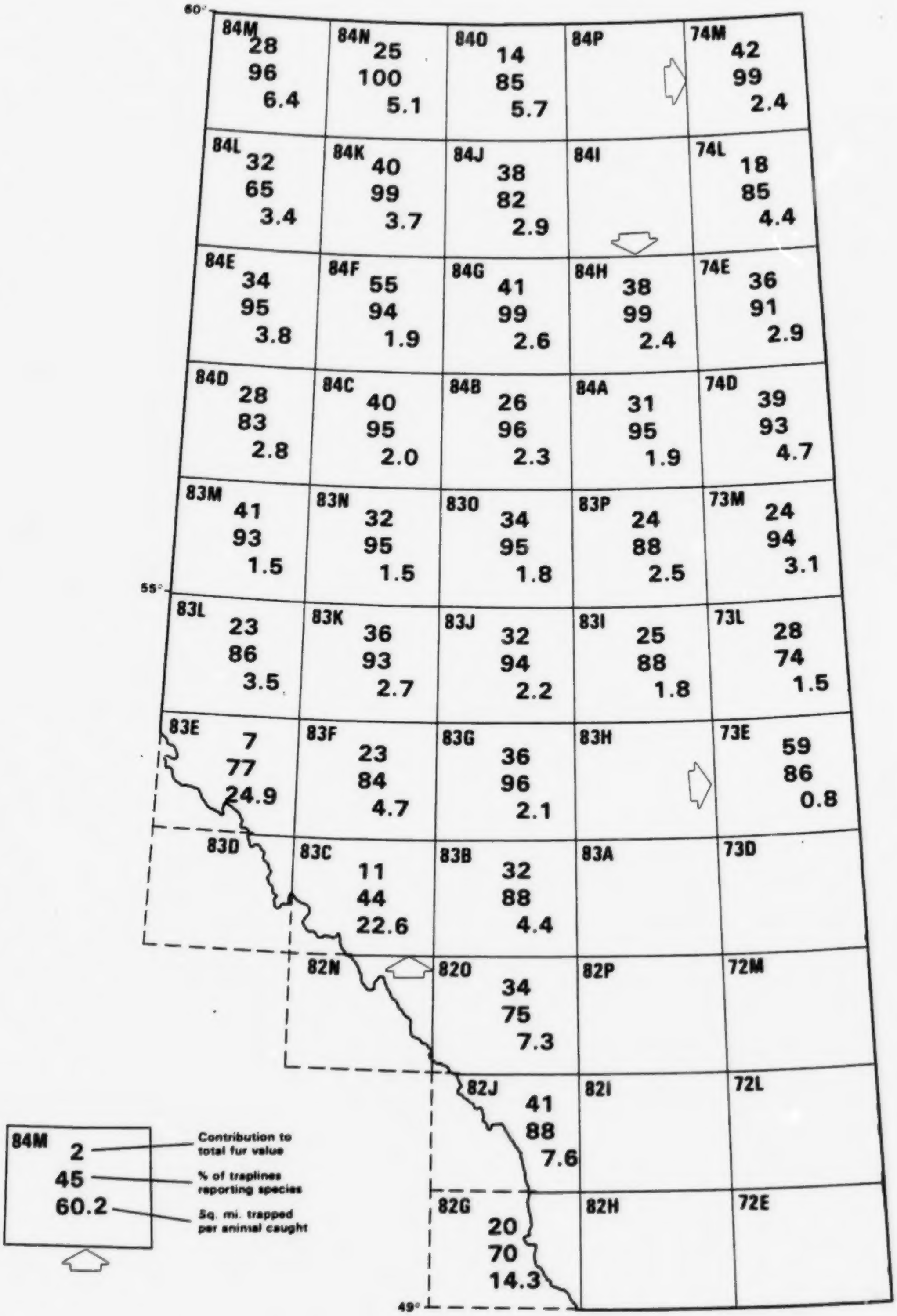

Figure 11.b: Distribution of Beaver Harvest, 1970-1975; taken from Boyd, 1977.

# RIVER OTTER

# 12. KEY HABITAT REQUIREMENTS FOR THE RIVER OTTER

## 12.1 General

The river otter (Lutra canadensis) is a semi-aquatic furbearer with commercial value.[13] Being a mobile species, it requires large tracts of suitable habitat. Its main habitat requirements include access to water year-round, adequate food supply, den sites and shoreline cover.[7,8,19,16] River otter exhibit a low reproductive potential and exist at low densities over their range with northeastern Alberta supporting the largest population.[8] The disappearance of river otter over much of their former range in Alberta has been attributed to overtrapping.[8,17]

The distribution and relative quality of river otter habitat in Alberta is depicted in Figure 12a. Distribution of river otter harvests is shown in Figure 12b.

## 12.2 Cover

### 12.2.1 Vegetation

Vegetation types used are highly variable.

Otters use riparian habitat on a localized basis; adequate shoreline cover (trees, shrubs, grasses, forbs) is required in the vicinity of dens and at latrine sites.[8,17,16].

Dense, riparian vegetation supported on undercut banks and upper banks provides excellent cover for otter, both in water and on land.[25]

Latrine sites, though typically well vegetated, may be more open than most of the contiguous bank.[25] In Montana, riparian habitat dominated by shrubs and marsh grass was preferred over sparse sagebrush, hayfields, early successional regions and non-vegetated banks.[25]

Cavities among roots of trees and in thickets of vegetation may be used as den sites or resting sites.[12,16]

Log jams may receive frequent use as resting sites, offering cover and a site from which to hunt.[16]

### 12.2.2 Land Forms and Topography

Otters use a variety of sites for temporary dens and resting areas. Temporary sites are often used by a number of unrelated otter.[14]

Otters utilize natural formations (e.g. talus rock, undercut banks) and dens made by other animals (fox, muskrat, beaver).[8,14,18, 19,16] Otters will re-excavate or fashion these den sites.[16,17]

Beaver lodges, often in association with some form of bank burrow, are frequently used as dens.[8,18,19]

Winter dens are often the route by which otters gain water and above-ground access.[17]

Beaver ponds and small bog lakes with leveed shorelines provide a bank for den sites and underwater access below the ice; the substratum generally is silt or detritus (can be dug through). Lake shorelines with gradually sloping sand, gravel or rock substratum are generally unsuitable winter habitat.[17]

Natal dens tend to be located well above high water levels and a considerable distance from permanent water (e.g. fox burrow).[19]

Distinct points/peninsulas on lakeshores, sandbars, large boulders and elevated banks may serve as latrine sites.[17,16]

In west central Idaho, otter preferred valley to mountain habitats; topography alone appeared to have little influence on movement.[16]

### 12.2.3 Climate

Frequency of above-ground movement between water bodies declines severely with cold winter conditions; movements tend to be under the ice and otter remain long periods in dens.[19]

Above-ground movements between habitat patches in mid-winter are energetically costly, and generally coincide with relatively mild weather conditions.[19]

Cavities in the snow, or snow caves made by otter, are used as temporary shelter and as feeding stations.[13]

Spring flooding of natal dens creates potential danger to helpless young.[19]

### 12.2.4 Aquatic Forms

Otters live in association with a wide variety of water sources; habitat composition and seasonal accessibility are important factors in determining water type used.[16]

Flowing water and interconnected aquatic forms are more valuable as river otter habitat than isolated standing water aquatic forms.

Medium-sized eutrophic and bog lakes provide good winter habitat.[19]

Otter may also use rapid areas in rivers, which remain exposed during winter;[1,16,17] streams which freeze over and cave-in due to a reduction in water flow, producing extensive air cavities, serve as potential winter habitat.[17]

In west central Idaho, otter preferred stream-associated habitats to lakes, ponds and reservoirs.[16] Use of lakes, reservoirs and ponds, as well as unobstructed portions of forest streams, was greatest during winter; mudflats and associated open marshes and swamps and backwater sloughs were used most often by otter during summer as rearing habitat.[16]

Turbid water and low flow volume may discourage otter use.[25]

Otter movement is generally along watercourses, though they will cross country from one water source to another using the shortest route possible.[16,19]

In streams impounded by beavers, otters may dig on the dam (rifting) to maintain an overflow of water which provides an access area in winter.[19]

Water acts as an escape medium for otter, and as a predator barrier for young in beaver lodges.[19]

Latrine sites are often located at river/stream confluences or mouths into lakes.[17]

## 12.3 Food

### 12.3.1 Vegetation

Vegetation is not a significant component of the diet.

### 12.3.2 Aquatic Forms

Beaver ponds, lakes, bogs, rivers and streams serve as feeding areas.

River otter are opportunistic feeders, consuming mainly forage fishes (e.g. minnows, sticklebacks) as well as some game species (e.g. trout, whitefish).[4,10,11,14,21,22,24]

Local abundance of fish, lake stratification, winter ice and individual fish species' swimming ability all may affect the availability of fish to otters.[21,24]

In Saskatchewan, the greatest densities of prey-sized fish (> 10 cm in length) were found in the back-eddies of rapids.[1]

Rapids or fast water regions may provide open access to food in winter.[1]

Rifting of beaver dams enables more frequent interchange and restocking of fish between successive ponds along a drainage, especially during high spring water levels.[19]

Crayfish are also a main component of the diet.[24]

Other items in the diet include aquatic invertebrates, aquatic insects and beetles, freshwater clams and amphibians (mainly frogs).[10,11,14,21,22,24]

Seasonal concentrations of invertebrate nymphs, moulting waterfowl and spawning fish represent a highly abundant food source for otter and is reflected in their diet.[17,4]

Mammals (as muskrat; Ondatra zibethicus and beaver; Castor canadensis) may be included in the diet, though they are relatively unimportant components.[10,14,24]

### 12.3.3. Climate

In winter, ice cover is often a barrier to otter trying to access water from the shore.[8,19,16]

Deep snow may also reduce access to potential food.[16]

## 12.4 Space

### 12.4.1 Territory/Home Range

Home ranges generally encompass large lengths of shoreline; drainage pattern determines home range shape.[16]

Prey availability, habitat, weather conditions, topography, reproductive status and population densities influence home range use and length.[16]

Seasonal variation in movement frequencies occurs, with increased movements in spring and autumn for both sexes.[18,19,20]

Portions of home range receive repetitive use during crucial periods such as winter.[18,19]

In northeastern Alberta, average home range size for females was 48.2 $km^2$ and 111.4 $km^2$ for males. In late winter, home ranges were $< 2.5$ $km^2$ for an adult male and $< 0.5$ $km^2$ for adult females.[19]

In the Kananaskis area, an adult male's range was 178 $km^2$ from May to November, while a female and her pups travelled in a 2 $km^2$ area from May to September and ranged 7.1 $km^2$ from October to mid-November.[9]

In Idaho, a female confined her activities to a 11.2 $km^2$ section of rivers and lakes, while adult males occupied 20-30 $km^2$ of water- way.[14,15]

There is extensive adult male/adult male and adult male/adult female overlap in home ranges. Adult female home ranges overlap less extensively.[17]

Young may restrain the movements of the female; they spend the first winter with the female and may move inside the female's range for the first two years.[18,19]

Animals in suboptimal habitat may have larger home ranges.[19]

### 12.4.2 Population Densities

In west cental Idaho, population densities ranged from 1 otter/2.7-5.8 (x = 3.9) km of waterway.[16] Density based on sex and social status was one breeding female/20 km of waterway, one adult male/53 km, and one yearling or nonbreeding adult/14 km.[16]

## 12.5 Special Considerations

### 12.5.1 Size, Shape and Juxtaposition of Habitat Components

Characteristic features of studied otter habitat include[8] waterways and marshes bordered by extensive forests, waterways containing slow moving pools with soft bottoms (as beaver ponds), high water quality with little turbidity or pollution and accessible water, year round. However, otter populations do exist in areas where all these charactersitics are not present.

A sizeable area of suitable habitat must be available since otters are a very mobile species, especially during the breeding season.[12]

Regions supporting a complex of water bodies and drainages in close proximity with abundant food provide good otter habitat.

Bog lakes, with adequate food resources and den sites along the shoreline, provide a less costly means of accessing food in winter than do a series of beaver ponds.[19]

Size and complexity of rapids contribute to their importance.[1] High densities of rapids may allow open, year-round access. Rivers with a strong current, small islands and complex shoreline may also provide good otter habitat.[1]

Locations of den sites are such that it is unnecessary for otter to travel any great distance to seek shelter while moving through the area.[13,19]

### 12.5.2 Significance of Disturbance Phenomena

Trapping. Over-trapping is the most common cause of otter elimination from areas in Alberta.[3,8]

Open trapping seasons on otters until 1961[23] may have prevented repopulation of former habitat in Alberta.[8]

Otters and beaver's use of water bodies overlap substantially,[18] thus otters are often accidentally trapped in beaver sets.[2,8,18]

Recreation. Recreational use of an area is not necessarily incompatible with river otters; stable populations can exist where continually confronted with human presence.[8]

However, if the major area of open water to which the otters require winter access coincide with areas of regular human activity otters may leave the area.[8]

Human activity which is intense and uncontrolled along stream banks may cause excessive erosion and siltation which may decrease food resources.[8]

Hydroelectric Development. Hydroelectric development which would inundate rapids and change water regimes may have a significant impact on otter.[1]

Other. Potential habitat disturbances which eliminate otter by destroying its habitat and/or removal of its prey base include; siltation and infilling, pollution, channelization, damming and draining wetlands, urbanization, industrialization, agricultural developments and timber harvest.[2]

## 12.6 Limiting Factors

River otter require aquatic habitat accessible year-round, with an adequate food supply.[16]

The river otter occupies only portions of its former range, although areas of uninhabited suitable habitat occur. A low reproductive potential and low population densities may limit otter expansion into former ranges, as may uncontrolled trapping.[8]

## 12.7 Regional Variation

River otter are uncommon in Alberta.

Areas of relatively high otter production are restricted to the eastern portion of the province in the boreal forest zone.[3] The distribution of higher producing areas in the northeast corner appears to be related to the Peace-Athabasca Delta complex and its adjacent river systems. High fish populations, which provide a main source of food for otter, may be an important factor in this area. Other high otter producing areas either include or are adjacent to the Department of National Defence Air Weapons Range near Cold Lake, and are currenlty closed to trapping.[3]

In northeastern Alberta, severe winters reduce the number of large open water areas to stretches of rapids on the larger rivers.[8]

Few otter reside in mountainous or prairie habitat.[17]

Regional differences in habitat use may be due to differences in habitat composition (water body morphology and drainage patterns).[16]

## ACKNOWLEDGMENTS

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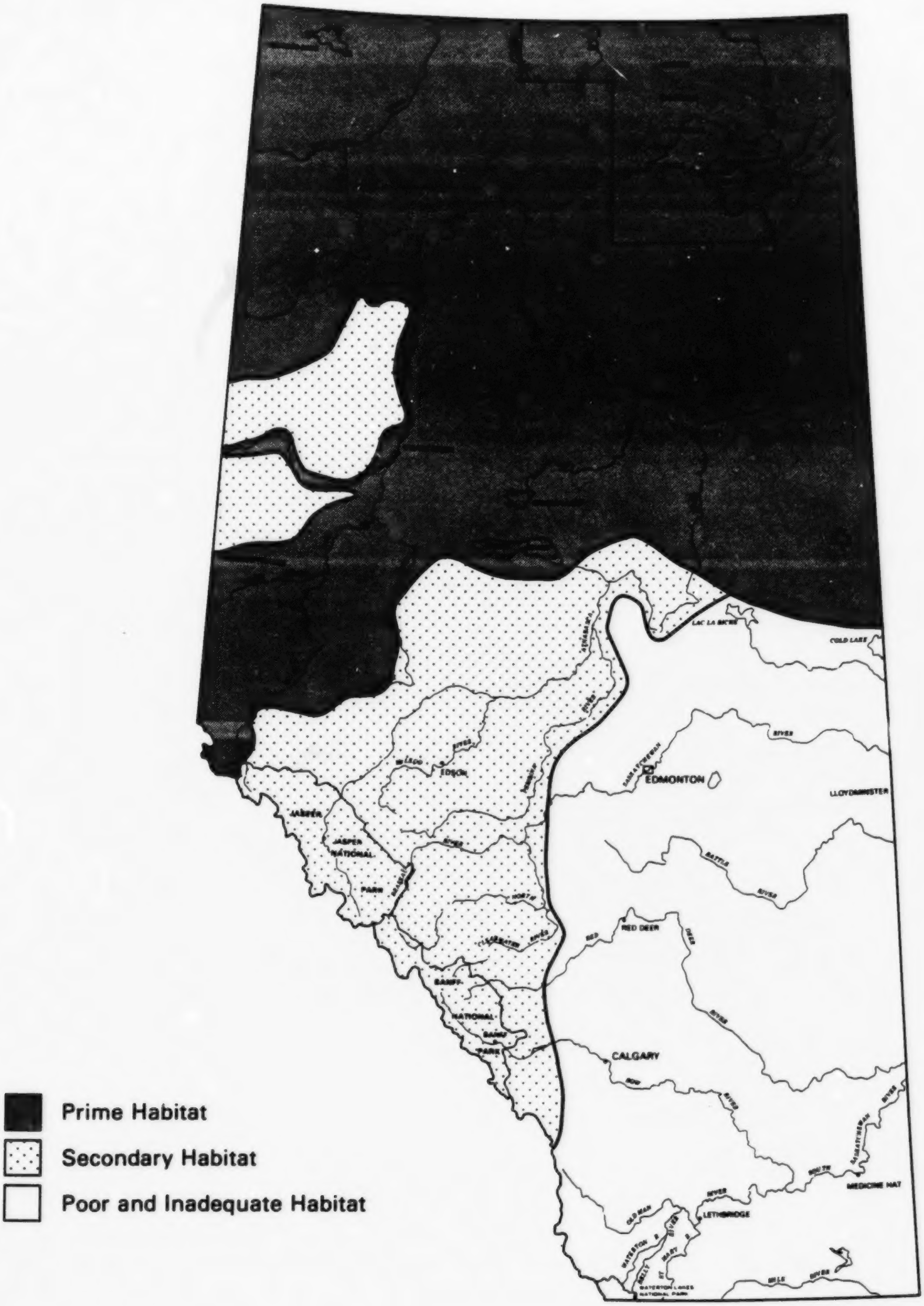

Figure 12a: General Distribution of Habitat Quality for River Otter in Alberta.

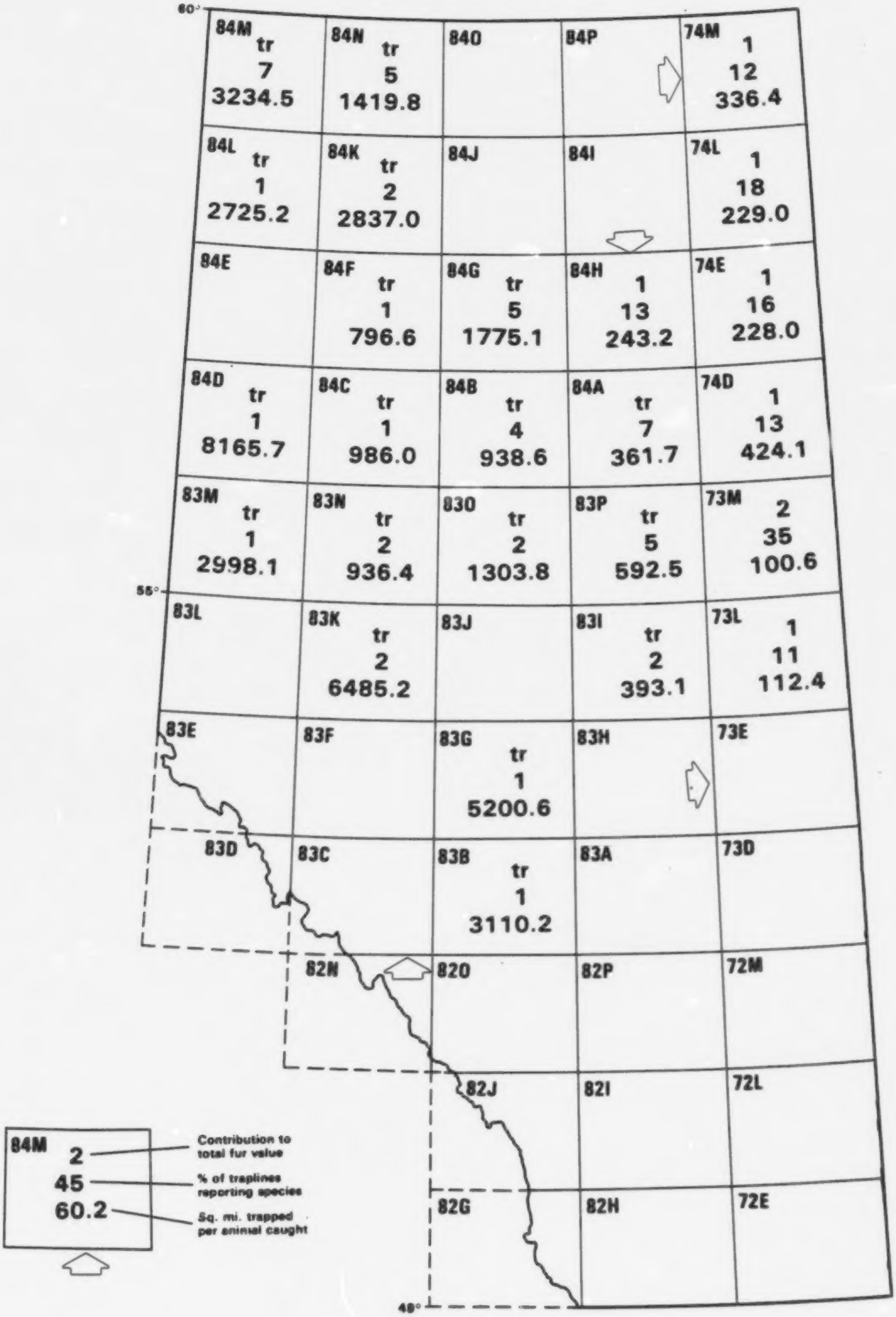

Figure 12.b: Distribution of River Otter Harvest; taken from Boyd, 1977.

# MARTEN

# 13. KEY HABITAT REQUIREMENTS FOR MARTEN

## 13.1 General

Marten (*Martes americana*) inhabits late successional forest communities throughout North America.[22] The species is most abundant in mature coniferous forests, but also inhabits mixedwood forests. Adequate cover and food availability are important factors influencing habitat selection, especially during winter. Open habitats may be used from spring through fall. Clearcut logging reduces the habitat suitability for marten.[25]

The distribution and relative quality of marten habitat in Alberta is shown in Figure 13a. Distribution of marten harvest in Alberta is shown in Figure 13b.

## 13.2 Cover

### 13.2.1 Vegetation

Pine marten rely on closed, coniferous-dominated, mixedwood forests which are mature or over-mature.[4,10,14,19, 22,23,24,29]

In the Eastern Slopes Region, fir (*Abies* Spp.), Engelmann spruce (*Picea engelmannii*) and white spruce (*Picea glauca*) dominated stands of moderate to high density provide good marten habitat; mature lodgepole pine (*Pinus contorta*) stands will also be utilized if they include spruce and fir or adjoin such stands.[28]

In boreal forest habitat, mesic coniferous and mixed coniferous-deciduous stands of moderate to high density appear to be used most frequently; upland white spruce dominated stands are of particular importance.[8,24]

At Grande Cache, marten used lodgepole pine and spruce stands in proportion to their availability.[4]

Streamside reserves protected from forest cutting could be important as movement/dispersal corridors and reservoirs for marten re-establishment in areas of extensive timber removal.[28]

Marten have a greater dependence on treed areas in winter; a canopy cover of >30 per cent (preferably 40-60 per cent) has been suggested for optimum winter habitat.[1,19]

Marten avoid extremely dense stands which suppress herbaceous cover.

Marten use more open habitats during spring through fall if they provide adequate cover and food.[13,19,27]

Cover is important as protection against aerial predation.[3]

Fallen trees which protrude above the snow are important in providing subnivean access to active small mammal prey.[5]

Summer resting sites include the crowns of conifers in uncut softwood and mixedwood stands.[26]

Winter resting sites are generally beneath the snow in uncut coniferous stands, at edges of clearcuts and residual stands; most sites are in or under hummocks associated with stumps or hollow logs, and under standing snags; maternal dens also occur in such areas.[26]

### 13.2.2 Land Forms and Topography

In mountainous areas of Alaska, marten were found at altitudes of 1 219-1 524 m as on summer ranges and <1 036 m on winter ranges.[21]
Ground burrows, rock piles and crevices are used as refuge sites.[23]

Maternal dens are often underground or in boulder areas.[27]

### 13.2.3 Climate

Closed coniferous or mixedwood stands provide more moderate micro- climate in winter for marten than other stands as temperature differentials and radiation fluxes are reduced.[17]

Greater snow depth in openings is a factor influencing selection of more dense cover.[19] Once snow depths exceed 30 cm, marten were found to avoid open areas >100 m in width.[18]

Marten remain active during periods of extreme cold (-40°C) and heavy snowfall, as well as during light and moderate rainfall,[16] though movements decrease under these conditions.[21]

## 13.3 Food

### 13.3.1 Vegetation/Animal Matter

Marten consume a wide variety of food materials if available.

Marten feed extensively, year round, upon small mammals,[3,7,9,10,21,25,30] the main food items in Alberta being meadow voles (Microtus pennsylvanicus) and red-backed voles (Clethrionomys gapperi).[11]

Other mammals in the diet include snowshoe hare (Lepus americanus), red squirrels (Tamiasciurus hudsonicus), ground squirrels (Spermophilus Sp.), weasel (Mustela Sp.), mink (Mustela vison), marten and carrion.[3,11,21]

Passerine birds and their eggs may be taken,[10] as well as grouse species;[11] these have a greater importance in the summer diet.

In summer, berries such as wild strawberry (Fragaria virginiana), huckleberry (Vaccinium membranaceum), and raspberry (Ribes Sp.) may be common components in the diet.[3,9,10,21,25,30]

Insects, when abundantly available, may also be included in spring and summer diets.[3,30]

In winter, marten hunt by investigating the bases of trees where rodents often surface and where snow depths are shallow enough to provide ready access to the subnivean environment.[3]

Habitat use by marten was found to closely parallel relative abundance of red-backed voles,[17,24].

Changes in abundance or availability of food may be reflected strongly in the marten's movements, its productivity, and habitat selection.[21]

### 13.3.2 Climate

Excessive snow depth (>30 cm) limits access to subnivean prey.[3, 4,19]

In open areas, snow further reduces cover resulting in little use of these areas for foraging.[3,19]

## 13.4 Space

### 13.4.1 Territory/Home Range

Marten populations are structured around male territories, which are rigidly defended during spring and summer months.[6]

Home ranges of males are distinct, but female home ranges often overlap those of other females and males.[6]

Home range sizes for males and females were, Wyoming, 2.4 $km^2$ and 0.9 $km^2$;[5] Ontario, 3.6 $km^2$ and 1.1 $km^2$;[9] Montana, 2.4 $km^2$ and 0.7$km^2$.[15]

Males and juvenile females tend to move greater distances than adult females.[21]

When food is very abundant, marten movements are greatly reduced.[21]

Marten appear to utilize shifting foraging areas within a larger home range area;[3,10] males in Ontario had larger average foraging areas than females (1.68 and .75 $km^2$, respectively) and tended to shift their ranges more frequently than females.[10]

Vertical migrations are known in Alaska; movements reflect seasonal shifts in abundance of food at different altitudes, related to the depth of snowfall.[20]

### 13.4.2 Population Densities

Marten densities fluctuate in relation to habitat types[25] and changes in the availability of food.[30]

In the Northwest Territories, highest densities were found in unbroken and slightly borken tracts of upland, coniferous-dominated stands of mixedwood forest. Riparian conifer-dominated forest types also received substantial use.[31,32]

Marten densities recorded in Ontario and Montana were 0.6-0.9/km$^2$ and 0.5-1.7/km$^2$, respectively.[30]

In Maine, partial timber harvesting had little effect on the density of marten, though commercial clearcutting reduced densities to about 25 per cent of original values.[25]

## 13.5 Special Considerations

### 13.5.1 Size, Shape and Juxtaposition of Habitat Components

Large tracts of unbroken mature forest with a well-developed understory support high marten populations.

Marten select for closed canopies +/- high density shrub cover.[8]

Stands of mature to over-mature (> 100 years) coniferous forest, comprised of 40 per cent fir or spruce, with a total canopy closure greater than 50 per cent should provide near optimal winter habitat.[1]

Marten reliance on dense mature mixed or coniferous stands may be related to prey abundance, evasion of predators, winter availability of prey, thermoregulation and availability of den sites.[28]

Windfalls, associated with old stands, are important as den sites as well as providing subnivean access.[5] Windfalls covering 20-50 per cent of the ground surface is considered optimum.[1]

Homogenous, mature spruce forest may support more marten over a given area, although a diversity of forest communities may support more marten over time.[28] A diverse forest is less susceptible to large-scale perturbations, provides a broader year-round food base, and continuous marten habitat over time through succession.

Marten require at least 2.6 km$^2$ of suitable habitat before an area will be occupied.[1] Corridors of adequate canopy and width are required to provide marten with cover when moving between suitable habitat patches.

Open areas >100 m in width are generally avoided during winter[19], though other cover (slash piles) may permit the use of these areas.[28]

Clearcuts will receive use if small islands of old stands are present.[12]

### 13.5.2 Significance of Disturbance Phenomena

Fire. Fire has been an important agent in establishing and maintaining a diversity of forest communities; it creates and maintains openings where abundant fruits, insects and small mammals provide food items for the marten during the summer.[19]

Trapping. Marten populations under sustained trapping pressure may not be capable of increase; a relatively large protected population of marten may be required to ensure population increase and expansion into adjacent trapped areas.[3]

Logging. Timber harvest can contribute to the decimation of marten populations.[33] In Wyoming, marten did not utilize harvested timber stands for at least a year; in Maine, clearcuts <15 years old were rarely used though marten occurred in partially harvested stands.[25]

Clear-cutting lowers the carrying capacity of an area for marten, resulting in larger home range size and lower population densities.[25] Freshly logged areas with slash piles, cull trees and other debris may receive notable use, even in winter, especially if small islands of old growth are scattered through the cutover.[12]

## 13.6 Limiting Factors

The per cent tree canopy closure (>50 per cent) and successional stage of the stand (> 100 years) are the two most limiting variables for determining the suitability of marten winter habitat.[1]

The presence of little or no spruce or fir in a forest stand will lower the value of the habitat for marten.[1]

Timber harvest can greatly reduce habitat quality for marten.

Excessive snow depth limits access to subnivean prey; prey availability affects population densities.[21]

Downfall is essential to provide optimum winter habitat.[1] Inadequate amounts may decrease the availability and accessibility of prey for marten.

## 13.7 Regional Variation

Regional importance of marten varies significantly throughout the province.

In terms of numbers harvested, the northwest corner and along the southwestern border of the province are more productive marten areas.[2] These areas correspond to the Hay River, lower foothills and upper foohills regions which are predominantly spruce and pine habitats with limited mixedwood elements.

## ACKNOWLEDGMENTS

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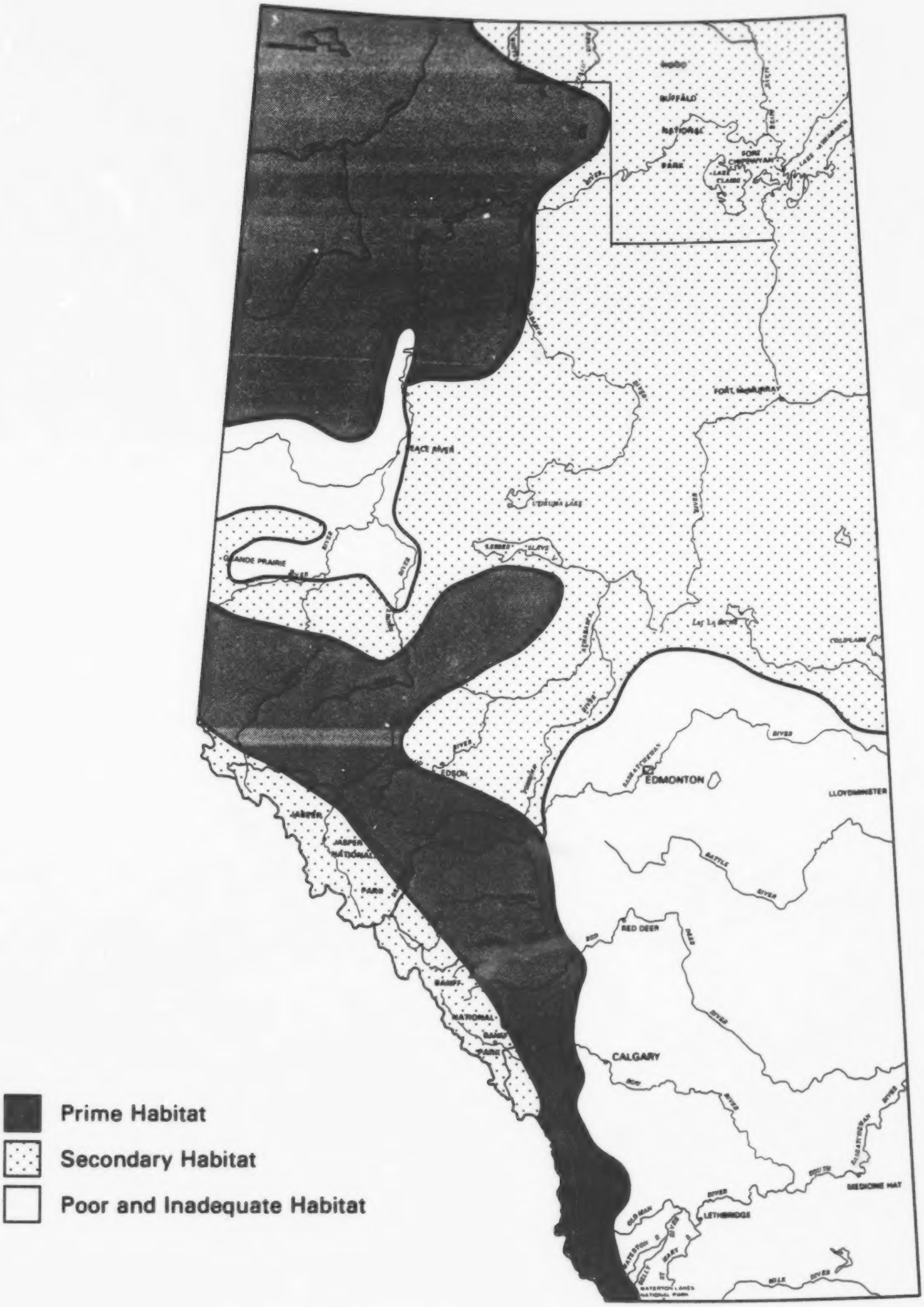


Figure 13a: General Distribution of Habitat Quality for Marten in Alberta.

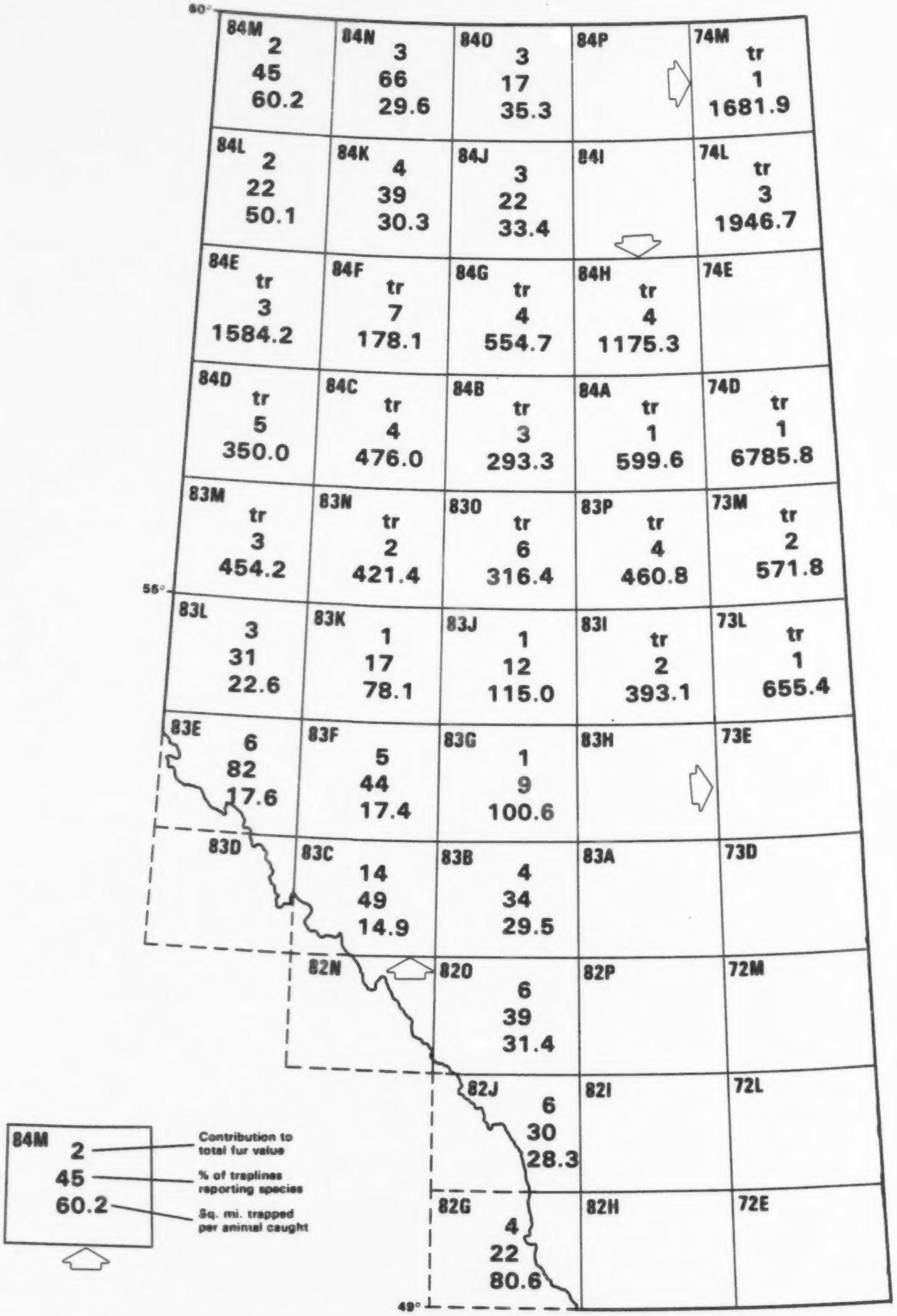
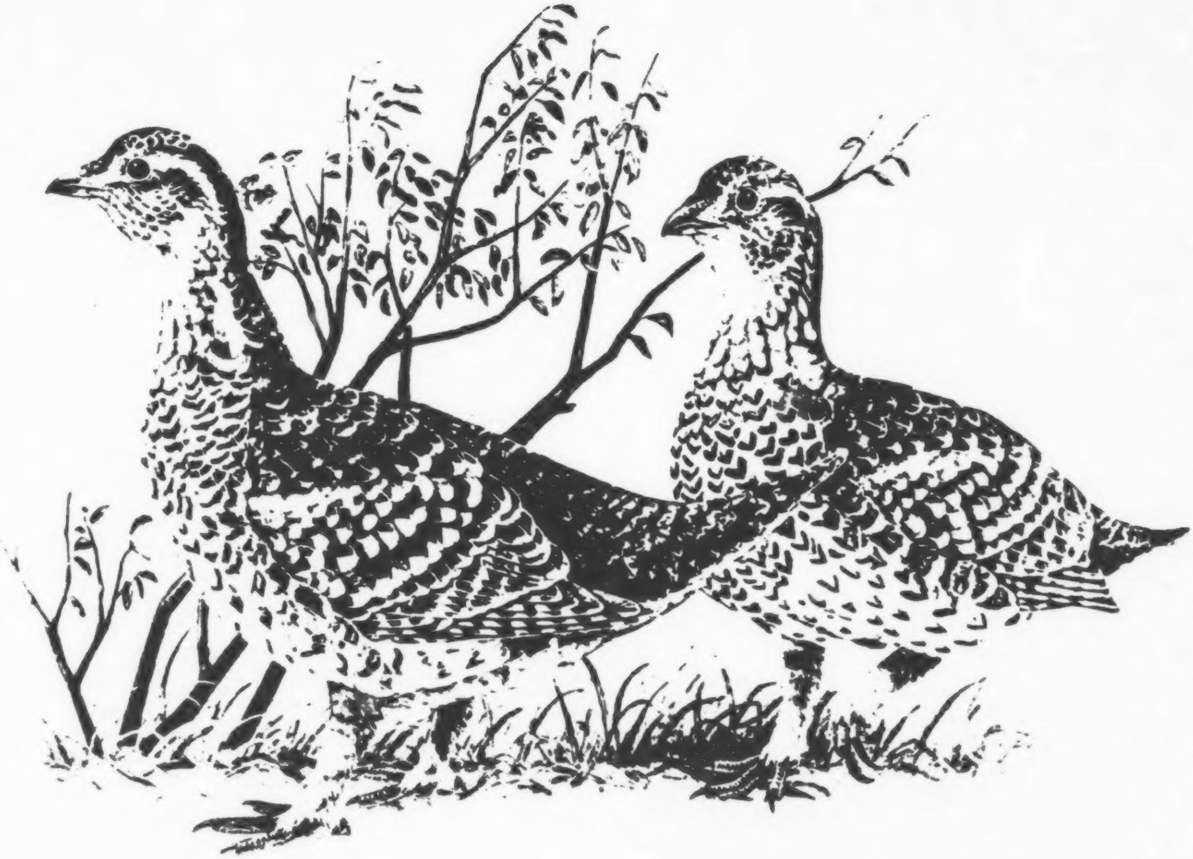


Figure 13.b: Distribution of Marten Harvest, 1970-1975; taken from Boyd, 1977.

# SHARP-TAILED GROUSE



# 14. KEY HABITAT REQUIREMENTS FOR SHARP-TAILED GROUSE

## 14.1 General

Sharp-tailed grouse (Pedioecetes phasianellus) occupy a variety of habitats in North America from open grasslands and sagebrush (Artemisia cana) through parklands, to early successional stages and open portions of mixedwoods and boreal forests.[2] They have also adapted to areas where agriculture has created a mosaic of native vegetation and to cultivated lands which provide sharptails with both food and cover requirements.[13,31]

Sharp-tailed grouse are scattered throughout Alberta in areas of suitable habitat. The distribution and relative quality of habitat is shown in Figure 14.

## 14.2 Cover

### 14.2.1 Vegetation

Sharptails require large areas of grass and shrubby cover during the spring and summer.[26,1,17,10,3]

Large acreages of grassy and/or shrubby vegetation is required in close proximity of a dancing ground if that area is to be maintained permanently.[31]

Sharptails favor edge habitats created by brush and aspen groves in the parkland zone and forest clearings near grain fields.

Male sharp-tailed grouse attending spring dancing grounds roost in nearby low shrub communities of snowberry (Symphoricarpos albus), rose (Rosa sp.) and silverberry (Elaeagnus commutata)[11,30] for protection from predators.

Females usually nest within 0.8 km of dancing grounds. A lush and dense residual growth of grass-sedges associated with short shrubs such as snowberry or rose is preferred nesting cover.[16,31,11,34]

Nesting habitat varies but is usually located in native grass and shrub, tame hay fields or cultivated stubble.[31]

Sharp-tails do not nest in treed bluffs or groves and nests are rarely found in vegetation taller than 6 m. In addition, nesting sites are rarely ever found in vegetation where the dominant species are shorter than 24.5 cm.[31,16,5,12]

In aspen parkland, nests are in close proximity to stands of woody vegetation, either aspen (Populus tremuloides) forest or dense shrub regrowth aspen. Distances to these vegetation types range from 4.7 to 14.0 m[32,31]

The physiognomy of cover is more important than species composition, generally heavy cover is chosen for the nest site.[20,31]

Sharp-tails nesting in undisturbed natural grass-shrub vegetation have significantly greater success than in areas under cultivation.[31]

Immediately after hatching, brood mobility is limited and broods are often found near their nest site.[4,12] Habitat selection is toward low grassy openings in brush. Use of shrubby vegetation increases as the broods become more mobile at four to six weeks of age.[4]

Broods use a greater variety of plants for cover than do nesting hens. Broods utilize cover composed of a greater proportion of forbs and a smaller proportion of grasses and shrubs than that used by nesting hens.[31,6]

Sharptails utilize plant invaders more for brooding than nesting and broods can generally tolerate more utilization of cover by domestic stock than do nesting hens.

Broods use light cover in early morning and evening but prefer heavier cover at midday.[31]

During the summer, broodless females spend much of the day in open forest cover or along the edge of a forested area.[32]

As summmer progresses, hens move their broods to areas of heavy cover, either aspen forest edge or dense aspen regrowth. Such areas are used extensively for midday resting. Morning and evening movements from these areas are only for short distances.[32]

During summer, females with broods use grassland and grassland-low shrub transition zones significantly more than other grouse including both males and females without broods.[29]

Sharptails make extensive use of woody vegetation for cover once herbaceous vegetation becomes desiccated. The extreme dryness may cause females and broods to seek heavier cover.[8]

In summer, grouse without broods select taller vegetative types, particularly tall shrubs. The heavier vegetation probably provides better cover from avian predators as well as cooler microclimate during the hottest part of the day.[29]

In autumn, sharptails move increasingly to woody cover for shelter from cold winds and predators.[17,70]

With the onset of winter and sub-zero weather, sharptails roost by burrowing into soft snow. The lee of aspen bluffs and clumps of low shrub also provide the birds with a degree of protective cover during adverse winter conditions.

In winter, grouse move into more open cover including (frozen) marsh during midday and roost predominantly in low cover in the evening.[29]

### 14.2.2 Land Forms and Topography

Native, grass-shrub vegetation on washed moraine, fluvial, fluvial lacustrine and high relief moraine land forms is likely to provide very good habitat for sharp-tails.

The most important characteristic of leks (dancing grounds) is their location on a slight rise or open flat area which affords the displaying grouse a wide horizontal field of vision in all directions.

### 14.2.3 Aquatic Forms

During winter, tall wetland sedges and cattails provide suitable roosting conditions.

### 14.2.4 Climate

Grouse often burrow under the snow to spend cold winter nights in protected tunnels.

The relationship between weather and plant community selected by grouse is not especially strong. Other factors such as food requirements, presence of conspecifics, familiarity with an area and avoidance of predators seem to have more importance in influencing choice of vegetation by grouse.[29]

## 14.3 Food

### 14.3.1 Vegetation

Sharptails are omnivorous and their diet includes fruits, green leaves, buds and insects.[31,19,34,23]

In spring, grouse feed mainly in grassland-low shrub transition zones and around the periphery of treed areas during early morning, and then seek taller vegetation for cover throughout midday. Grouse return to these grassland-low shrub communities after midday to again feed and roost.[29]

Favorite spring foods include aspen catkins, the first succulent leaves of forbs such as dandelion (Taraxacum sp.) and fruits which remain from the previous year.

Sharptail broods feed extensively in natural grass-shrub, cultivated crops and tame haylands but usually shun pastures grazed by livestock.[31]

All food taken by chicks until two weeks of age consists of animal material and other foods make up only 1.4 per cent by volume of the three to four week-old's diet.[31]

For chicks from five to 10 weeks of age, animal material still composes approximately 60-70 per cent of total food by volume.[31]

Plant material, largely composed of cultivated crops and weedy species, constitutes a rapidly increasing percentage of chick food in the older age classes.[31]

Chicks in the 13-16 week age group consume 2.5-6.5 per cent insect matter. High energy food such as domestic grains, seeds, berries, rosehips and green leaves are utilized exclusively by both juvenile and adult birds in late summer and fall.[31]

Sharptails exhibit mainly vegetarian food habits except for the chicks, and all food is largely composed of seeds and berries of wild fruits (most notable being rose), green leaves and flower heads and domestic grains where available.[31]

During the summer, sharptails feed in grasslands during early morning, and in the evening return to these open vegetation types to again feed and roost.[29]

In autumn, grouse use open vegetation communities in early morning for feeding, and move into taller, heavier cover by mid-morning. From midday to dark, grouse select grassland - low shrub transition for food and roosting.[29]

As fall foods become less available with the onset of winter, sharptails utilize buds of aspen, chokecherry (_Prunus virginiana_), birch (_Betula_ sp.) and willow (_Salix_ sp.). They still take fruits from rose, silverberry (_Elaeagnus commutata_) and snowberry (_Symphoricarpos albus_) as well as domestic grain where available.[18]

Favorable winter habitat consists of wooded areas where tree buds are available and grassy areas which supply seeds.

In winter, sharptails often perch in aspen trees to eat buds during morning and midday.[29]

Sharptails have never been shown to depend upon drinking water in their natural habitat, apparently meeting moisture requirements from succulent foods.

### 14.3.2 Trace Elements

Unlike some gallinaceous birds, adult sharptails do not appear dependent on gravel for digestive grit because of the hard grinding surfaces provided by the seeds of fruits commonly eaten.[15]

Chicks, on the other hand, being almost totally insectivorous, consume large amounts of grit.[31]

## 14.4 Space

### 14.4.1 Territory/Home Range

On the dancing ground, the resident males establish small territories adjacent to each other. Each territory is usually only 1.8 to 2.7 metres across and variable in shape.[31]

Established males appear to be faithful to one dancing ground and frequent that particular ground during breeding seasons, and during the autumn and winter, for as long as they are capable of defending a territory.[30,31,14]

The location of most summer observations of sharptails is found to be within a 1.6 km radius of a dancing ground.[31]

Sharptail nesting sites are located within 1.6 km of the nearest dancing ground and on average the distance is approximately 900 metres.[31]

Non-brooding females make short, daily movements within small, definable areas. Females with broods moved over larger areas and do not appear to have a constant home range for any length of time.[32]

Tracking data indicate that movement by broods between one and two weeks of age were quite limited, generally less than 0.2 km per day. By three to four weeks of age, movements averaged 0.5 km per day. Older broods also averaged 0.5 km per day but some long distance movements typical of the four to 10 week-plus age groups were as far as 1.5 km in an eight hour-period.[32]

## 14.5 Special Considerations

### 14.5.1 Size, Shape and Juxtaposition of Habitat Components

Sharptails attain highest densities in habitat mosaics of grass, shrubs and trees. Shelter from extremes of climate and predators is important for survival.

It is believed that grouse have specific preferences for different plant communities at different times of the year and of the day. Thus a mosaic of plant communities, particularly grassland and grassland-shrub mixtures with extensive ecotones, provides optimum habitat.[29]

The presence of suitable nesting and brooding cover within 1.6 km of the dancing ground strongly influenced the breeding population.[31,11]

Grouse in the Prairies prefer large acreages of grassland, preferably in various stages of succession if maximum populations are to be maintained.[22]

Female sharptail grouse require a diversity of habitat types. Open areas are required for feeding, shrubby areas for nesting, and areas of tall aspen regrowth or forested stands for escape cover and midday resting sites for broods.[32]

Native grass and shrub areas are essential in maintaining year-round sharptail populations.[31,8,19]

### 14.5.2 Significance of Disturbance Phenomena

Fire. Because of increasing agricultural use and fire prevention, trees are invading the grasslands in aspen parkland areas. This is leading to a reduction in the number of arenas and consequently lower productivity.[35]

Fire is known to be an important factor in creating and maintaining seral and subclimax grass-shrub conditions favored by sharp-tailed grouse.[3,21,33]

Fire-disturbed areas have large numbers of insects which supply high protein animal matter required as food by newly hatched grouse for the first four to six weeks following hatching.[35]

Agriculture. Intensive grazing by over-stocking of a grassland ecosystem leads to destruction of vegetation used by nesting sharptail hens and also damages the woody cover used by sharptail broods.[27] Decline of sharp-tailed grouse populations caused by intensive grazing have been noted by many researchers.[9,31,24,34,37]

Pastures grazed with a season-long grazing system produced better grassland habitat for sharp-tailed grouse than pastures with a deferred rotation grazing system.[27]

Initially, agricultural development was beneficial to grouse distribution and numbers as large tracts of native vegetation were still interspersed with cropland areas. However, in recent times, populations have declined as this diversity has been destroyed with the advent of modern, intensive clean-farming practices.

Weather/Predation. Damp, windy weather and harassment by humans or predators depresses breeding activity.[31] Hens seldom return the same morning after having been disturbed on a lek.[30]

## 14.6 Limiting Factors

Carrying capacity for sharptails is limited by the availability of large acreages of ungrazed grass-shrub and hayland within a 1.6 km radius of a dancing ground. This ungrazed herbaceous vegetation is very important to the habitat requirements of sharptails during both the spring breeding season and the summer nesting and brooding season.[31]

The amount of continuous aspen cover within a radius of 0.8 km of a display site or arena is inversely related to the number of grouse which frequent the area. This apparent inverse relationship suggests that with increasing percentages of aspen cover, fewer sharptails will be present.[29]

Homogeneous grassland vegetation lacking a shrub component is unattractive to sharptails because it does not offer sufficient protective cover and forage capabilities.

Light to moderate grazing in tall to medium grasslands of the Prairies, reduced, and in some cases eliminated, sharptails.[22]

Agricultural activities such as haying or summer fallowing cause significant nest destruction or abandonment.[31]

Sharptail chicks feed heavily on insects, consequently they may be subjected to possible hazards from chemical pesticide control used in association with agricultural practices.[31]

Applications of sublethal doses of dieldrin, an insecticide used to control agricultural insect pests, caused sharptails to be more prone to predation for up to 12 days after application.[28]

The elimination of wild prairie fires which destroy woody vegetation and favor the growth of forbs and grasses, results in tree and tall shrub-dominating growth and reduces habitat quality.[22,25,36]

## 14.7 Regional Variation

The distribution of prime sharptail habitat in the province is located mainly in the Short Grass, Mixed Grass, Aspen Parkland, and southern-southwestern Boreal Mixed-wood Ecoregions.

## ACKNOWLEDGMENTS

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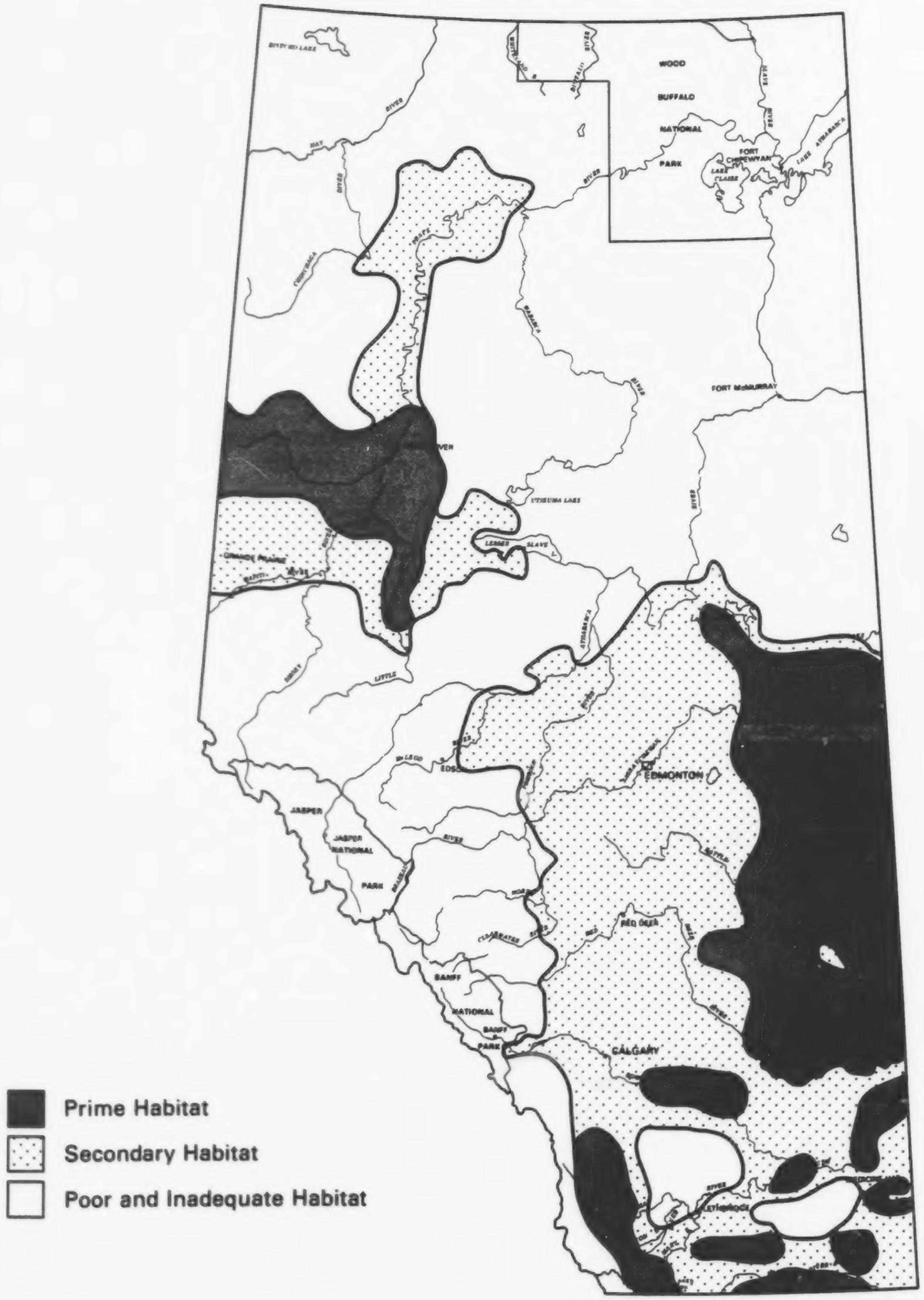

Figure 14; General Distribution of Habitat Quality for Sharp-tailed Grouse in Alberta.

# RING-NECKED PHEASANT

# 15. KEY HABITAT REQUIREMENTS FOR RING-NECKED PHEASANT

## 15.1 General

In Alberta, ring-necked pheasants (Phasianus colchicus) exist at the northern limit of their North American range.[14] Dense winter cover, such as cattail marshes or shelterbelts, in close proximity to spring nesting sites and cultivated cropland, is the essential habitat requirement. Wetlands are an extremely important element of pheasant habitat and their retention is of utmost importance in ensuring continued pheasant populations in Alberta.

The distribution and relative quality of ring-necked pheasant habitat in Alberta is depicted in Figure 15.

## 15.2 Cover

### 15.2.1 Vegetation

Cattail-willow (Typha latifolia-Salix sp.) complexes and other marshy vegetation associated with wetlands represent the best available winter cover for pheasants.

Dense, low, shrubby cover can be important but its value deteriorates with even moderate snowfall and drifting.[10]

In areas of deeper snow such as the parkland region, thicker, more substantial cover such as multi-row shelterbelts are required.

In cold weather, woodlots, low lying forest pockets and narrow strip cover are usually avoided but will be used if other suitable cover is not available.[10]

In late summer and fall, pheasants basically prefer to roost in relatively open vegetation types such as grass and stubble fields with close proximity to escape cover;[17] during wind, snow or rain, brushy areas or dense marshy vegetation are used.[17]

Loafing areas usually contain dusting grounds and pheasants will choose sunny or shady sites depending on their thermal requirements.

A variety of cover types are used for nesting but undisturbed residual cover (>25cm), such as dry grasses and weedy forbs, are most important for early nesting attempts. These have the best chances of successful hatching.[25]

As the nesting season progresses, alfalfa (Medicago sativa) becomes increasingly preferred for nesting sites, however, haying usually occurs during peak hatch and as a result nesting success is low.

In South Dakota, alfalfa was the most preferred of all cover, even over natural vegetation.[13]

Stands of cover with more than 50 per cent shrub component have low nesting value.[6]

Wetlands, strip cover along roadsides, fencelines and railways, and fields of hay, fall rye (Secale cereale) or winter wheat (Triticum sp.), which still retain vegetation from the previous year, are optimum areas for nesting.[9]

Hay and strip cover usually carry higher nesting densities than heavily grazed pastures, woodlands or small grazing fields.

Very narrow strip vegetation may have limited value because ground predators can more efficiently search these habitats;[22] predators may also use these areas as travel lanes.[1]

Other locations often used for nesting cover include: field borders, shelterbelts, marsh edges, stream and ditch banks and abandoned farmsteads.[25]

In Wisconsin, early nesting attempts are located primarily in hayfields where the vegetation exhibits early growth.[7]

There is a high use of hay, grain and herbaceous vegetation for brooding,[11] which is dense enough for predator protection, but not so dense as to prevent chicks from moving about and staying together.[18]

### 15.2.2 Land Forms and Topography

The best pheasant populations in Alberta are associated with irrigation districts.

Preferred vegetation types are found along drainages and in wetland basins where natural cover has not been substantially altered by agricultural land use.

Small localized areas of moraine, fluvial and eroded lands, unsuitable for agricultural development, support remnant pheasant populations; areas suitable for agriculture are more productive.

Pheasants prefer valleys and lowlands in late fall and winter (probably because uplands are cropped); spring dispersal tends to be in the direction of the uplands.[21]

### 15.2.3 Aquatic Forms

Wetland areas which provide dense emergent vegetation (eg. cattails) and riparian herbaceous/shrub vegetation are most valuable as cover, especially in late fall and winter.

Wetlands can provide escape cover in fall during hunting if water depth is $<$ 12 cm.

Pheasants show a strong tendency toward stream bottoms and coulees,[22] especially in southern Alberta where it is their only source of cover and water.

### 15.2.4 Climate

Snowfall and drifting decrease the effectiveness of cover and make many cover areas unavailable for use.[10,17]

Severe winter conditions create a need for increased cover requirements (larger and more dense stands of woody and herbaceous cover). Survival may depend on the proximity of food to dense cover.[16]

During periods of wind, snow, or rain, pheasants utilize brushy areas or dense, marshy vegetation to a larger degree as roosting sites.[17]

## 15.3 Food

### 15.3.1 Vegetation

Adult pheasants utilize farm crops more heavily than native vegetation or animal matter.

Seeds, leaves and fruit of domestic crops including corn (Zea mays), wheat (Triticum sp.), barley (Hordeum sp.), oats (Avena sativa), flax (Linum usitatissium), rye, alfalfa and clover (Trifolium sp.) are the principal foods of pheasants; seeds from native vegetation can be emergency food stuffs and are the sole food supply in some areas.[15]

Adult pheasants in South Dakota consumed: 82 per cent farm crops, 7 per cent weed seed, 5 per cent insects, 5 per cent foliage and 1 per cent minerals; juveniles consume the same food items but greater amounts of insects which are a rich source of protein needed for growth.[23]

The seeds of farm crops are utilized most heavily in mid-winter while insects and green foliage are important as food items in the spring and early summer.[23]

### 15.3.2 Aquatic Forms

Water in free forms such as ponds, creeks and irrigation ditches is not usually necessary, as dew, insects and succulent vegetation generally provide a sufficient supply.[25]

In dry areas, free water is important to survival.

### 15.3.3 Climate

15 cm of snow, especially if packed and covering waste grains, can be sufficient to create food stress unless alternate food is available.[10]

Pheasants can scratch through 38 cm of snow, though energy expenditure may be greater than that obtained.[10]

In restrictive snow conditions, farmsteads and roadsides may be the final sources of food for pheasants.[10]

### 15.3.4 Trace Elements

Calcareous grit, used as a grinding agent in the gizzard, is also an important source of calcium for pheasants whose normal diet of cereal grains is low in this element.[4,15]

## 15.4 Space

### 15.4.1 Territory/Home Range

Pheasants generally have very small home ranges.[3,20]

Most literature suggests that daily movements are usually within one kilometer.[16]

Seasonal movements usually range from 1-3.5 km and very seldom exceed 5.5 km.[16]

## 15.5 Special Considerations

### 15.5.1 Size, Shape and Juxtaposition of Habitat Components

The type of land use which is especially productive for pheasants in the plains and prairie is 25 per cent row crops, 50 per cent cereal crops, 15 per cent hay and pasture and 10 per cent idle lands supporting shelterbelts, slough margins, willow thickets and weeds.[6] This interspersion provides sufficient waste grain for food and meets cover requirements for nesting, brooding and winter shelter.

Pheasants show preference for areas with 1) high hay/non-hay ratio; 2) a high cereal crop/row crop ratio; 3) the greatest possible field crop diversity; 4) an abundance of wetland cover types.[6]

Proper juxtaposition of cover types, with adequate wintering areas linked to feeding and nesting sites by well covered travel lanes, is most important.

Nesting areas should be within a 2.5 km$^2$ block (a minimum of 8 ha in size; which also provides the minimum winter cover size requirements). On each of these 2.5 km$^2$ blocks, at least 5 per cent of the land and optimally 20 per cent of the land must be left as undisturbed nesting cover, preferably with a high proportion of wetlands.[8]

Densities of territorial males are usually highest in areas of greatest cover interspersion, where food supplies occur in close proximity to roosting and loafing cover.[2]

Dusting and grit-picking sites tend to be more exposed areas, adjacent to denser escape cover.[25]

Some studies noted preference for the edge area for nesting while others found the distribution to be random.[16]

Prime pheasant habitat usually lies in fertile black or brown soil areas (grassland region) which have the most favorable land use patterns for pheasants.[3]

### 15.5.2 Significance of Disturbance Phenomena

Agriculture. Cultivated lands provide pheasants with their prime food supply; more advanced farming practices tend to leave fields virtually bare of waste grains.[6]

The best pheasant habitat exists where 85-90 per cent of the land is under cultivation but sufficient cover may be found on lands with up to 95 per cent cultivation.

High nest and hen mortalities result from mowing in hayfield nesting cover at the time of nesting.[19]

Human Activity. Pheasants are bothered little by human activity if sufficient cover is available.

Lanes and roads are often used as dusting and loafing areas.[5]

Pheasant-rearing programs establish and supplement wild pheasant populations in Alberta.

## 15.6 Limiting Factors

Severe winter conditions in most years may be a primary limiting factor; pheasants are generally restricted to locations where January mean temperatures are above -15°C and mid-winter snow depths average less than 20 cm.[22]

They are limited where more than 95 per cent of the land is cultivated, where few wetland acreages occur, where progressively more of the landscape is wooded, where the soils are progressively less fertile and where the growing season is shorter.[24]

The available habitat of pheasants is decreasing as more intensive agriculture produces larger, cleaner fields reducing both food and cover supplies.

## 15.7 Regional Variations

Habitat quality and pheasant population numbers decline from the Short Grass and Mixed Grass Ecoregions to the Aspen Parkland Ecoregion, primarily because of increasing winter severity, deeper snow conditions, colder winter temperatures, infrequent chinook events and shorter growing seasons.

Suitable habitat and climate does not exist in other portions of the province.

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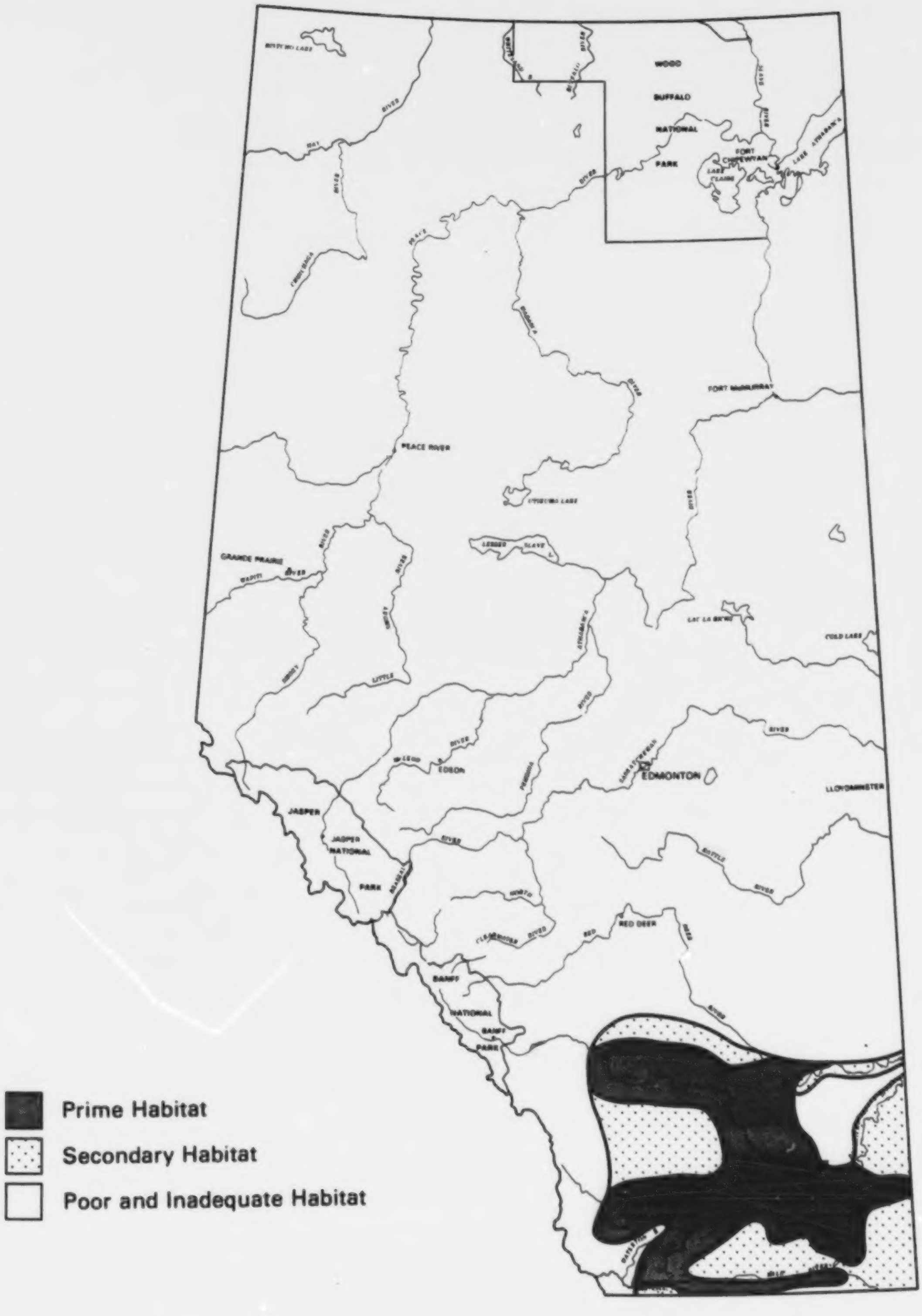
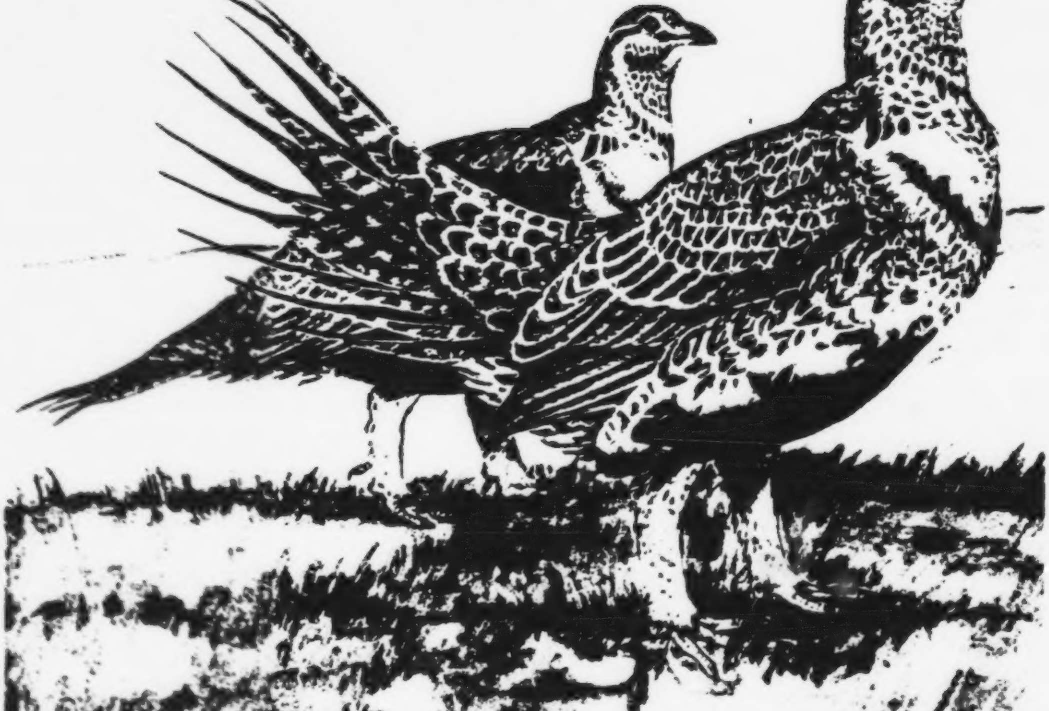


Figure 15: General Distribution of Habitat Quality for Ring-necked Pheasant in Alberta.

# SAGE GROUSE



# 16. KEY HABITAT REQUIREMENTS OF SAGE GROUSE

## 16.1 General

Sage grouse (*Centrocercus urophasianus*) are limited to the extreme southeastern part of Alberta, where semi-arid grasslands and sagebrush plains form their only habitat.[3] Few other species are so totally dependent on and restricted to one habitat type. Sagebrush (*Artemisia cana*) is essential to sage grouse for food and cover; the birds' diet is primarily sagebrush throughout the year, especially in winter.[3,27] Thus, sage grouse populations are determined by availability and distribution of sagebrush.

The distribution of sage grouse habitat in Alberta is depicted on Figure 16.

## 16.2 Cover

### 16.2.1 Vegetation

Sagebrush communities form the main cover for shelter, nesting, loafing, roosting and feeding.

Vegetation associated with sagebrush varies widely. Western wheatgrass (*Agropyron smithii*) is the most frequently associated grass at all densities of sagebrush.[6] Sandberg's bluegrass (*Poa secunda*) and June grass (*Koeleria cristata*) are closely associated with Western wheatgrass; pasture sedge (*Artemisia frigida*) is the most frequently associated forb.

Wintering areas are dominated by dense stands of sagebrush cover.[7]

Loafing and roosting areas invariably coincide with the heaviest and most dense sagebrush cover.[18]

Winter feeding and loafing sites averaged 28 per cent sagebrush cover in Montana.[29]

Fifteen percent canopy coverage of sagebrush was classified as the minimum coverage acceptable for sage grouse winter and nesting habitat.[7,28,29]

In Colorado, sagebrush canopy cover of spring habitat averaged 33 per cent for male-use sites and 28 percent for female-use sites; average sagebrush height at feeding-loafing sites was 28 cm for males and 22 cm for females.[22]

Sage grouse prefer relatively open areas as strutting grounds,[18,23] though these must be surrounded by adequate sagebrush required for food and cover.[9,27]

In Montana, 80 per cent of the feeding and loafing locations of strutting cocks were in sagebrush canopy of 20-50 per cent (average 32 per cent); no cocks were observed in < 10 per cent cover.[29]

Sagebrush seems to be preferred for nesting cover, though other vegetation is occasionally used.[2]

In Montana, average height of sagebrush cover over all nests was 40.4 cm as compared with 23.4 cm in surrounding areas.[28] Successful nests were located in sagebrush stands with a higher average canopy coverage than those of unsuccessful nests, and had a significantly greater sagebrush cover within 60 cm of the nest and within a 9 m radius.

The productivity of grasses and forbs in an area may also influence the number of nests and nesting success.[11]

Unsuccessful breeding hen flocks were found in areas of dense sagebrush throughout the summer in Montana.[26]

Sage grouse broods in Montana preferred relatively open stands of sagebrush compared to those selected at other times of the year.[26]

On summering areas in Wyoming, meadowlands and hayfields were used as feeding sites, willow (*Salix* sp.) and sagebrush were used for resting and shading, and areas of sparse, low-growing sagebrush were used as night roosting areas.[11,18]

### 16.2.2 Land Forms and Topography

Native sagebrush - grass vegetation confined to primarily heavy clay bottoms, coulees, creeks and rivers provide habitat for sage grouse in Alberta.[3]

Strutting grounds tend to be in open areas with little slope.[18]

In Wyoming, most strutting areas occurred on windswept ridges or exposed knolls, flat, open sagebrush areas, and bare openings on relatively level land.[18]

In Montana, most roosting, feeding, and loafing sites were on terrain with little if any slope; birds were never encountered on steep terrain although dense stands of sagebrush occurred there.[7]

In Idaho, where birds undergo elevational migrations, sage grouse exhibited little preference for slope.[4]

Sage grouse may use topography as protection from wind.[7]

### 16.2.3 Climate

Except for shade from summer heat, adult sage grouse require little protection from the elements.[2]

During severe winters, dense sagebrush may provide shelter.[7,26]

Inclement weather may inhibit strutting activities and ground attendance.[24]

Cold, rainy weather at hatching time may result in lowered productivity.[2]

Winds greater than 16-24 kmph were found to cause movement off flat ridges.[7]

## 16.3 Food

### 16.3.1 Vegetation

Sage grouse do not possess a muscular gizzard and therefore lack the capability of grinding and digesting seeds.

The year-round diet consists of leafy vegetation with the exception of some insects taken during summer.

During winter, sage grouse depend entirely on sagebrush for food, which also forms a staple item in diets during other seasons.[18,20,27] As an evergreen shrub, sagebrush provides a nutritious, available food source throughout the year.

Feeding primarily occurs in stands of sagebrush of intermediate height and density.[18]

Meadows and haylands surrounded by sagebrush are used as summer feeding sites.[3]

Juvenile grouse rely on insects and forbs during the summer period.[14,19,20]

Grasshoppers, beetles, and ants are the most common animal matter items in the diet, which may comprise > 40 per cent of the chicks diet.[19,11]

Forbs become the most important component of the juvenile diet after one to two weeks of age.[14]

Succulent forbs, dandelion (Taraxacum sp.) and alfalfa (Medicago sativa), preferred foods of sage grouse broods, are an important element of the summer habitat.[9,15,26]

Sagebrush begins to form a significant part of the diet only after 12 weeks of age.[14]

Sagebrush and forbs are the major components of adult summer diets; availability may influence the proportion in the diet.[18,27]

### 16.3.2 Aquatic Forms

Loafing and roosting areas are usually in close association to a water supply.[16]

Birds congregate around water during dry periods, but disperse after rain.[25]

Nesting areas have been found to occur within short distances of water sources, and migrations of broods to summering areas may follow accessible waterways.[10,11,18]

During years of above average rainfall, sage grouse chicks obtain most of their water from succulent vegetation and dew.[25]

### 16.3.3 Climate

Sage grouse may occupy windswept sagebrush ridges during winter where accessible, though lower and scantier growth sagebrush occurs.[21]

When snow depth exceeds approximately 30.5 cm, sage grouse are restricted to taller sagebrush stands, which may represent only a small portion of a normal wintering area.[27]

Small areas of sagebrush may not be adequate for sage grouse to survive the sometimes severe winters.[3]

## 16.4 Space

### 16.4.1 Territory/Home Range

Sage grouse in Alberta are not known to exhibit any major seasonal movements[3], possibly due to interspersion of wintering, nesting and brood habitats as was found for eastern Montana birds.[7]

Winter range, summer range, breeding, nesting and brood rearing may all occur in separate areas,[2] or a number of activities may occur on one habitat complex.[7]

With snow, sage grouse move to ranges where exposed sagebrush provides food.[1]

Winter ranges in Montana varied from 1059 - 3143 ha; 75 per cent of the minimum daily movements were < 1.2 km.[7]

In spring, sage grouse begin movement to strutting grounds which may be on winter or summer range.[5,9]

Thirty-one strutting grounds have been located in Alberta.[12]

Birds show an affinity for particular strutting grounds.[18]

Strutting grounds may vary in size from 0.4 - 16 ha.[23]

Total area defended by master cocks rarely exceeds 6.1 m in radius from the primary mating spot (rarely exceeds 1.5 m radius).[9]

After being bred, hens select a nesting site which may be located near the strutting grounds[5], or at some distance from them, usually in sagebrush.[23,18]

In Montana, most nests were found within a 2.4 km radius of the strutting ground.[28]

Males move to summer ranges after they abandon the strutting grounds,[4] and were found to remain within 3.2-4.8 km of the strutting grounds in Montana.[27]

After hatching, broods move to summer range,[8,9] which may be restricted to areas supporting succulent vegetation (40 - 80 ha ranges in Montana).[26]

### 16.4.2 Population Densities

Sage grouse are gregarious throughout the year, with the exception of nesting hens.[27]

Sagebrush density is a major factor influencing sage grouse distributions.[7]

Considerable variability in size of winter flocks was found in Montana; hen flocks varied from 4-50 birds except during severe weather when concentrations of > 200 birds were recorded, winter cock flocks ranged from 5-15 birds and occurred near hen flocks.[7,27]

Male sage grouse densities on strutting grounds averaged 26.6 cocks/lek in Alberta during 1968-1983.[12]

Hens begin to cluster during breeding, with groups ranging in size from a few to 100 females in Montana.[27]

Male flocks remain segregated from broods and hen flocks in summer, but may remain in close proximity to them.[29]

## 16.5 Special Considerations

### 16.5.1 Size, Shape and Juxtaposition of Habitat Components

Large expanses of sagebrush, encompassing a water source, and interspersed with meadows and haylands provide sage grouse habitat. Dispersed, small openings (a couple of hectares) on flat ground surrounded by 3-4 $km^2$ of dense sagebrush provide good lekking areas with adjacent nesting habitat.

### 16.5.2 Significance of Disturbance Phenomena

Agriculture. Potential conflicts exist between sage grouse and agricultural activities.

Agriculturalists continue to advocate re-seeding native grasslands to domestic forages to increase livestock production, posing a potential threat to sagebrush prairie.[3,15]

Although sage grouse may tolerate drastic physical changes in their strutting areas before abandoning them,[25] elimination of sagebrush around these may result in abandonment or termination of breeding activites at an earlier date.[8] A 3.2 km radius buffer zone around the strutting grounds should be protected.[7]

Most of Alberta's sage grouse habitat is used as rangeland for domestic livestock, mainly cattle.[3] Cattle may compete with sage grouse for sagebrush food, particularly when too many cattle are wintered on sagebrush ranges.

Overgrazing can cause serious decline in sage grouse populations.[18]

A sagebrush climax, with a good balance of grasses and forbs as understory species, through proper grazing practices, is recommended.[18]

Human Activity. Strutting grounds which are readily accessible by road may be subjected to disturbance which could seriously affect the breeding of the population.[12]

New strutting grounds may be constructed by removing 0.4-0.8 ha of sagebrush within a sagebrush expanse.[13]

Fire. Natural fires can reduce sagebrush ranges.[3]

## 16.6 Limiting Factors

Sage grouse populations are limited by the availability and distribution of sagebrush.[17] Sagebrush is an important year-round food as well as providing cover and shelter. Adequate sagebrush must surround strutting grounds for breeding to occur.[7,29] Agricultural demands may pose a threat to sagebrush habitat.

Nest destruction is probably the most significant factor controlling sage grouse production.[3]

Severe weather conditions, unless snow completely covers the sagebrush, have little effect on the birds.[27] An exception may be cold, rainy weather during hatching, decreasing productivity.[2]

### 16.7 Regional Variation

The sage grouse occurs only in the extreme southeast portion of the province where adequate expanses of sagebrush are found.

## ACKNOWLEDGMENTS

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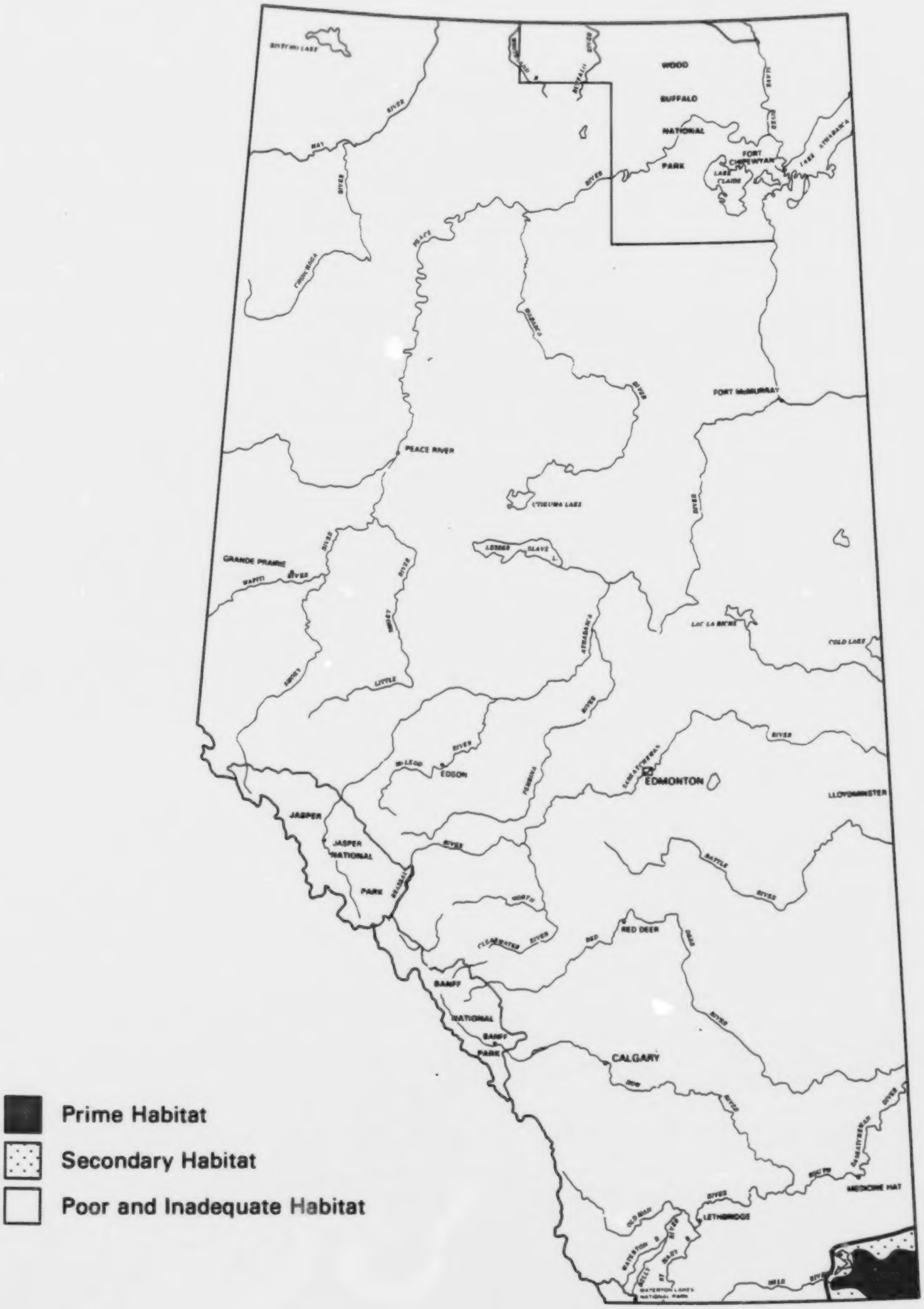

Figure 16: General Distribution of Habitat Quality for Sage Grouse in Alberta.

# BREEDING DABBLER DUCKS

# 17. KEY HABITAT REQUIREMENTS FOR RESIDENT BREEDING DABBLING DUCKS

Alberta's breeding dabbling ducks include the mallard (*Anas platyrhynchos*), pintail (*Anas acuta*), northern shoveler (*Anas clypeata*), blue-winged teal (*Anas discors*), green-winged teal (*Anas crecca*), gadwall (*Anas strepera*) and American widgeon (*Anas americana*).

## 17.1 General

Water is essential to waterfowl habitat. Areas supporting high densities of shallow wetlands in fertile prairie-parkland regions provide the most productive breeding habitat in Alberta, habitat that ranks among the best in North America. Within these areas, largely devoted to agriculture, the less intensive and more diversified farming practices are most likely to result in the retention of higher quality habitat.

Distribution, relative abundances, production areas and harvest regions are depicted in Figures 17a - 17c. Priority duck production habitat is listed in Table 2.

## 17.2 Cover

### 17.2.1 Vegetation

Nest site selection is influenced both by environmental factors and by interaction among the nesting ducks.

Nest cover is provided by sedges (*Carex* sp.), mixed prairie grasses, hardstem bulrush (*Scirpus* sp.), great bulrush (*Scirpus acutus*) and rushes (*Juncus* sp.); forbes such as whitetop (*Erigeron* sp.), nettles (*Urtica* sp.), thistles (*Cirsium* sp.), fireweed (*Epilobium angustifolium*) and lambsquarter (*Chenopodium album*), as well as shrubs such as buckbrush (*Symphoricarpos occidentalis*) and gooseberry (*Ribes* sp.).[1,16,18,26]

Selection of nest sites is influenced by the degree of vegetation cover; in central Alberta ducks preferred vegetation in the 1.5 - 3.4 dm range.[18]

Residual vegetation from the previous year is used by early nesting species.[28,32]

Pioneer vegetation, sparse forbs, forest and pure stands of tall reed grass (*Calamagrostis* sp.) were avoided as nesting areas in central Alberta.[18]

Hayfields, stubble fields, grain fields, pastures and roadsides also serve as nesting sites, especially for pintail.[20]

Broods often use potholes ringed with emergent vegetation and surrounded by haylands or ungrazed woodland.[26]

Broods show a strong tendency to stay in or near concealing vegetation such as sedges and bulrushes.[9]

### 17.2.2 Land Forms and Topography

Moraine, especially higher relief moraine, supports the greatest density of wetlands and the highest densities of breeding ducks.[23]

In Saskatchewan, lacustrine and solonetzic soil land systems were associated with a low density of wetlands, lack of permanency of wetlands due to shallow basins and intensive cultivation (lack of upland nesting cover), resulting in relatively poor areas for duck production.[23] Fluvial, alluvium, aeolian, saline, eroded drainage and meltwater channel land systems tended to support low wetland densities.

Islands, dikes, levees,[33] fields and roadside ditches serve as nesting sites.

### 17.2.3 Aquatic Forms

Interspersion of shallow marshes, open water marshes, and open water wetlands provide good breeding habitat.[23]

The most preferred of all habitats by resident dabblers in Alberta are semi-permanent potholes of up to 1 m deep in summer.[26]

Northern shoveler pairs whose core areas were small water areas (< 0.4 ha) made use of several ponds centered near the nest site.

Mallard broods favored potholes 0.04-0.2 ha at Lousana, Alberta[2] and 0.2-0.4 ha in Saskatchewan parklands.[29] Blue-winged teal broods often occupy ponds 0.04-0.2 ha in size[29]; American wigeon prefer semi-permanent areas of 0.2-0.4 ha, though at Lousana, broods favored larger potholes (0.8-2.0 ha).[26] Stockponds are also used by blue-winged teal and mallard.[29]

Broods frequently move from pond to pond.[1]

During years of low precipitation ducks require some permanent water bodies which last into late summer for brood salvage.

Creeks and rivers may form key duck production habitat if they contain water into mid-summer, support good emergent growth and meander extensively or have many oxbow lakes within their flood plain.[23]

### 17.2.4 Climate

Cold spring conditions delay nesting.[25]

Emergent vegetation traps drifting snow, increasing the insulation which causes a thinner sheet of ice to form. These areas are first to melt in the spring and are therefore most attractive to early nesting pairs.[14]

The amount of growing season precipitation and spring runoff determines the number of potholes available for duck use.

Drought seriously affects upland cover, reducing growth and thus the protective nature of the vegetation. Danger to broods is also intensified by the need for more frequent and longer excursions overland in search of water.[25]

Drought decreases the number of potholes available; ducks may be forced to fly further north to boreal habitat.[10]

Ducks exhibit a strong tendency to choose loafing sites on the leeward side when on an island.[18]

## 17.3 Food

### 17.3.1 Vegetation

Dabbling ducks are primarily herbivorous, with the exception of brooding hens and young ducklings.[21,26]

Various aquatic plants, including duckweed (*Lemna* sp.), pondweeds (*Potamogeton* sp.), bulrushes, sedges and smartweed (*Polygonum* sp.) provide important food for both adult and juvenile ducks.[16,26,27]

Dabbling ducks, particularly mallards and pintails, make extensive use of cereal grains in spring and fall[2,27]

Hens require a diet high in aquatic and terrestrial invertebrates to supply them with the increased protein demand during laying.[2]

The diet of the newly hatched duckling is dominated by pond surface invertebrates. As the duckling ages these are replaced by aquatic invertebrates and by three weeks the diet is largely herbivorous, with less than 10 per cent animal food.[31]

### 17.3.2 Land Forms and Topography

Wetlands developed on saline soils generally produce fewer ducks than fresh wetlands as they lack dense emergent growth and support fewer invertebrates.[23]

### 17.3.3 Aquatic Forms

Stagnant sloughs, ponds and other wetland areas provide the various aquatic plants used by dabbler ducks.

Seasonal wetlands are important feeding sites in spring when invertebrate populations are high. As these basins dry out, the ducks shift to semi-permanent ponds and lakes and feed on adult aquatic insects.[23]

Wetlands surrounded by undisturbed plant communities have higher production of invertebrate food than areas disturbed through agriculture.[23]

## 17.4 Space

### 17.4.1 Territory/Home Range

The summer ranges of dabbling ducks vary in size according to each species, population density and habitat conditions; in Manitoba, the home range of mallards exceeded 280 ha though the core area was smaller, the territory of blue-winged teals averaged 7-100 ha.[6,19] In Utah, the territory of the gadwall ranged from 14-36 ha.[8] In Alberta, the home range of the northern shoveler averaged 30.4 ha; parts of most home ranges overlapped and some were completely within boundaries of others.[22]

On islands, mallards nest in close proximity to geese (within 30m);[18] pintails nest in association with terns.[33]

In the fall, most dabbling ducks migrate to winter range mainly in the southern United States and Mexico, and return to northern regions in early spring.[1]

### 17.4.2 Population Densities

Population densities of dabbler ducks are presented in Table 1.

Table 1
MEAN DENSITIES OF DABBLER DUCKS FOR VARIOUS ECOLOGICAL ZONES IN ALBERTA (MEASURED IN BREEDING PAIRS PER KM$^2$)[1]

| | Short Grass Prairie | Mixed Grass Prairie | Aspen Parkland | Boreal Forest |
|---|---|---|---|---|
| Mallard | -- | 32.2 | 70.7 | 2.8 |
| Pintail | 40.4 | 60.1 | 28.5-38.1 | 3.1 |
| Northern Shoveler | 3.6 | 17.4 | 18.8 | very low |
| Blue-winged Teal | -- | 19.9 | 42.0 | 3.4 |
| Green-winged Teal | 2.1 | 4.9 | 13.0 | 5.4 |
| Gadwall | 3.9 | 10.9 | 17.6 | very low |
| American Wigeon | 6.5 | 8.0 | 19.2 | 3.4 |

## 17.5 Special Considerations

### 17.5.1 Size, Shape and Juxtaposition of Habitat Components

Dabbling duck breeding pair densities and species diversity are greatest on wetland areas with a high interspersion of land and water.[15]

Wetland complexes within 1.5-3.0 km of fields with undisturbed grass and legume cover provide good habitat for breeding pairs and broods.[7]

The broken pattern of emergent aquatic growth in parkland potholes is often used for brood cover.[21] The extent of nesting is proportionate to the quality and quantity of marsh vegetation occurring along the shoreline and in the shallow water.[9]

The degree of difference in height and density of vegetation at an interface is an important factor in nest site selection; there was a tendency for nesting ducks to situate within 3 m of plant association interfaces in the denser vegetation in central Alberta.[18]

The majority of dabbler nests are found 30.5 - 45.5m from the water's edge, with some nests as far as 135 m from the shoreline;[9,16] nests close to water decrease the time for the ducks to reach the security of water.[26]

Diversified land use patterns in the nesting area contribute to better duck production than areas under intensively tilled grain monocultures.[5]

### 17.5.2 Significance of Disturbance Phenomena

Managed Flooding/Drainage. Temporary drainage of an area, maintains a high level of marsh productivity; after flooding the area peaks in use by ducks because of the abundance of pioneer plants such as duckweed.[4]

The changes in marsh and aquatic vegetation create an increased interspersion of cover and water.[11,13]

Drainage of marsh areas considerably reduces the invertebrate population for a few years until slow repopulation takes place.[14]

Progressive succession of an area from pioneer plants to more stable rooted aquatics such as pondweeds reduces the productivity for ducks.[4]

Drought decreases the number of potholes available; ducks may be forced to fly further north to boreal habitat.[10]

Agriculture. Land clearing can open up tree and shrub-ringed potholes, making them more accessible and attractive to ducks.[12]

The draining of wetlands for agricultural expansion destroys good waterfowl habitat.

Cereal grain fields provide a supplementary food supply particularly during early spring and fall.

Cultivation of steep morainal hillsides exposes them to wind and water erosion and speeds up the siltation and filling-in of nearby potholes.[12]

Road construction frequently creates new habitat for ducks by dividing large, deep potholes into two separate bodies of water; ditches created by roads collect runoff and are attractive to ducks.[12]

Nests are destroyed each year by agricultural activities such as cultivation, mowing, burning of stubble and pasture lands, fence building and road construction.[12]

Agriculture creates long narrow bands of cover which are easily searched by nest predators.[24]

Human Disturbance. Human activity can affect the use of an area by waterfowl in all seasons,[18] but particularly during the nesting season.

Hunting pressure may cause changes in the use of areas.

## 17.6 Limiting Factors

Ducks are limited in areas with excessive water fluctuations; insufficient nutrients in the water and soil for optimum plant growth; permeable soils which adversely affect the formation and permanency of wetlands; deep, open water with steep shorelines and poorly developed marsh areas; shallow potholes which dry up quickly in the spring.[3]

Considerable wind and wave action on large water bodies reduces shoreline productivity and cover, and is particularly hazardous to young ducklings.[29]

Type and density of nesting cover will affect nesting suitability.

## 17.7 Regional Variations

Numerous ponds and potholes of the aspen parkland and prairie grassland regions provide optimum habitat for large populations of dabbler ducks. Gently to moderately-sloping ground moraine promotes the development of high densities of wetlands with well-developed marsh edges. Higher average precipitation in the parkland region results in a higher proportion of permanent wetlands as compared to the prairie region. The parkland provides a wide range of cover, water and nesting and brooding sites, and the clearing of tree cover in central Alberta has increased the use of potholes that were once unattractive to ducks.[27]

Draining of wetlands for agricultural use in the grasslands and parkland regions has destroyed much prime duck habitat. Nest sites are often found in stubble, fallow and crop fields which leads to their destruction.

On average, ducks exist in lower numbers in the northern mixed wood, but in times of drought in southern regions, the north provides important stable habitat for ducks.

The large expanse of land in the boreal region with numerous lakes and streams make possible a substantial contribution to waterfowl habitat. Water forms do not undergo as wide fluctuations in water levels as in the more southern regions.

Slow, meandering streams, ox-bow lakes, deltas and beaver ponds which support emergent vegetation and aquatic food resources gain importance as duck production habitat in the boreal region. Lakes surrounded by dense tree cover and lacking a shoreline discourage dabbler use.

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E. Hofman (Alberta Fish and Wildlife, Brooks), W. Wishart (Alberta Fish and Wildlife, Edmonton) and L. Shandruk (Can. Wild. Ser.) provided critical reviews and useful comments.

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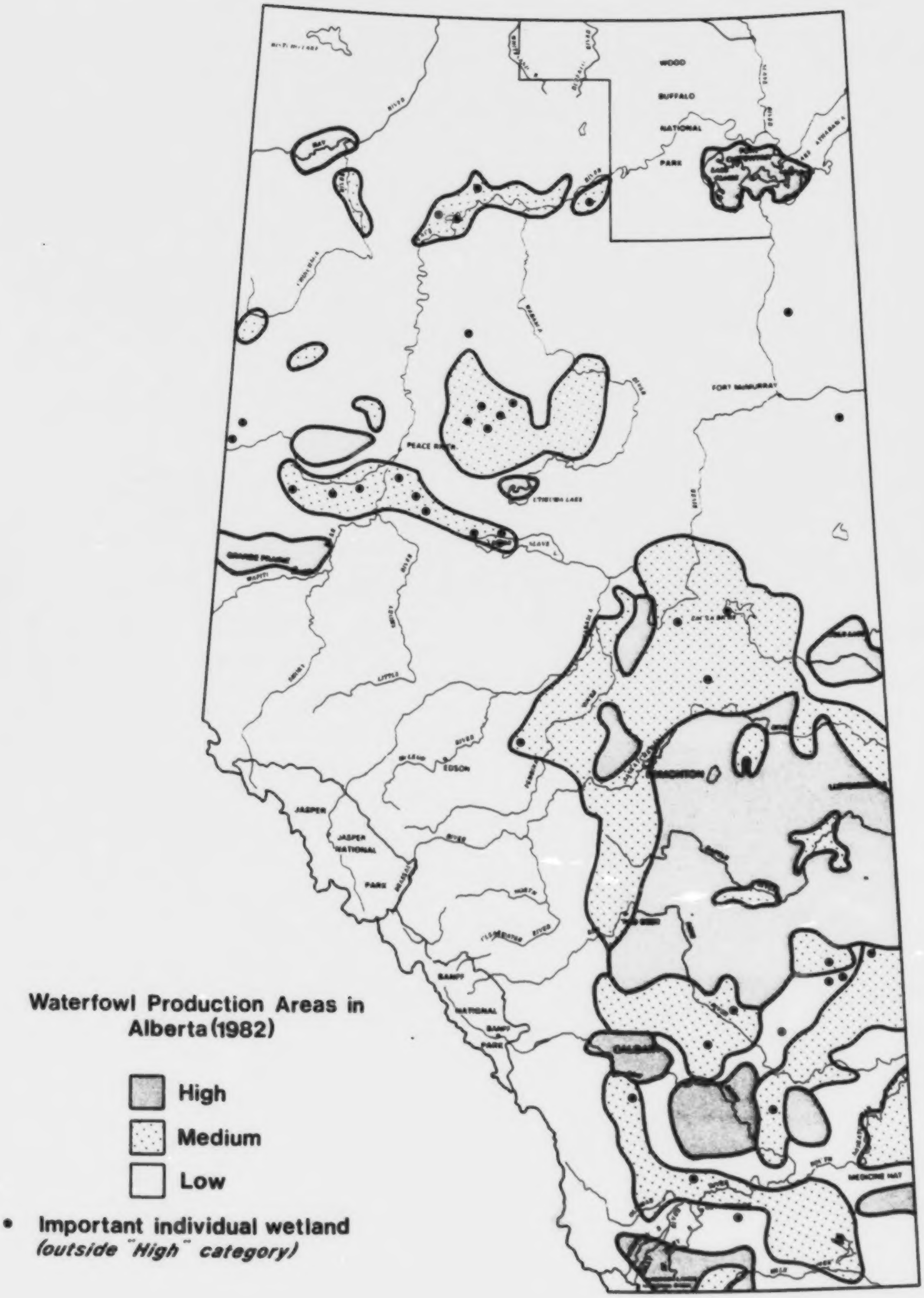

Figure 17.a: Distribution and Relative Abundance of Waterfowl in Alberta, 1982.

SOURCE: Adapted from Technical Discussion Paper for Waterfowl Management in Alberta. Unpublished draft, May/85. Fish and Wildlife Division, ENR. Edmonton. 120 pp.

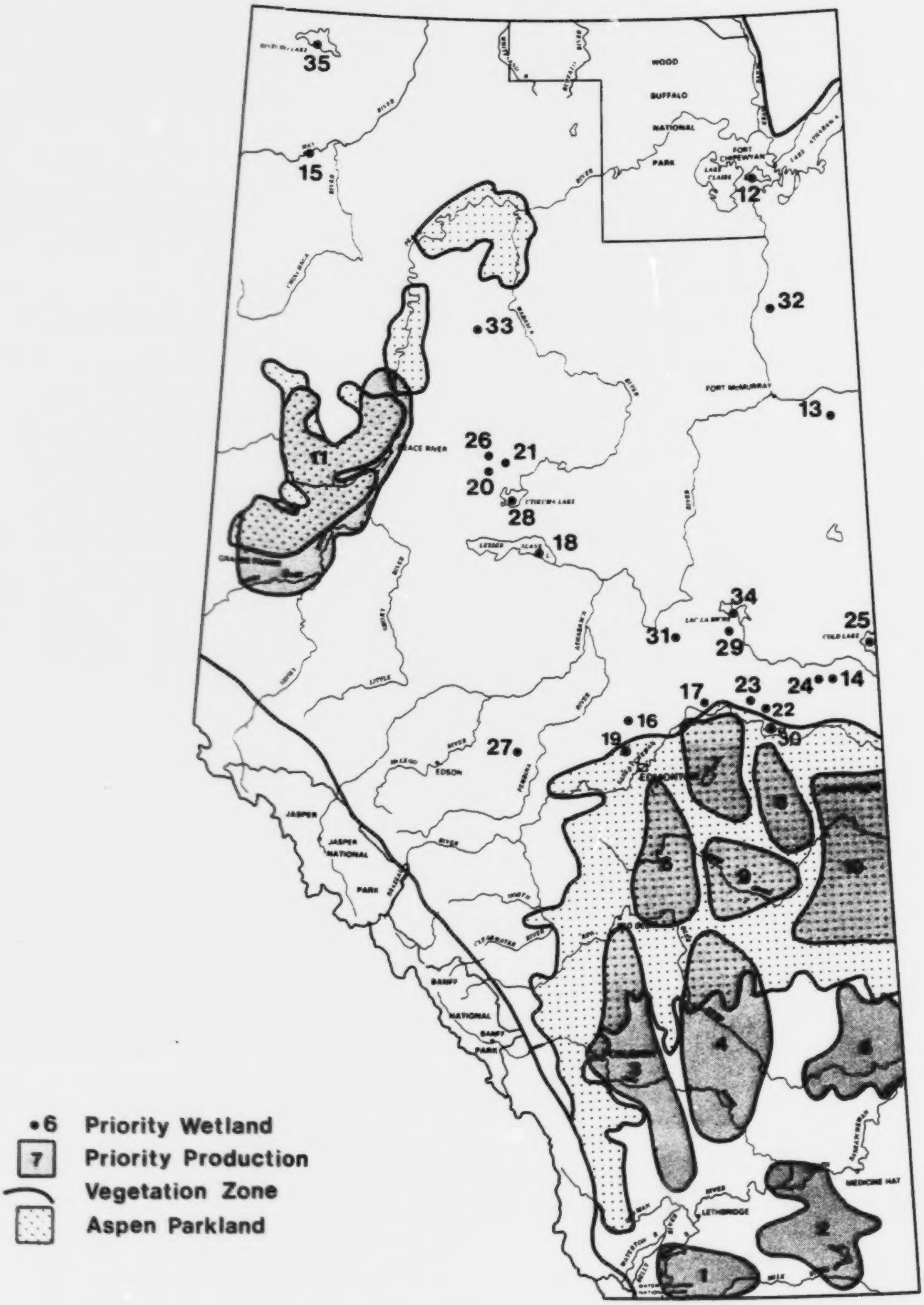

**Figure 17.b: Priority Duck Production Habitat in Alberta.**

SOURCE: Adapted from Migratory Bird Habitat Priorities; Prairie Provinces. Unpublished Report, June 1979. Canadian Wildlife Service. Edmonton. 104 pp.

### Table 2
### PRIORITY DUCK PRODUCTION HABITAT IN ALBERTA
(Refer to Figure 17b)

| AREA NO. | NAME | PRIORITY | VEGETATION ZONE | SIZE (hectares) |
|---|---|---|---|---|
| 1. | Milk River Ridge | High | Grassland | |
| 2. | Stirling-Etzikom-Cypress Hills | Medium | Grassland | 312 000 |
| 3. | Innisfail-Strathmore-Keho Lake | Medium | Grassland | 580 000 |
| 4. | Drumheller-Bassano-Brooks | Medium | Grassland | 1 480 000 |
| 5. | Compeer-Acadia Valley-Berry Creek | Medium | Grassland | 530 000 |
| 6. | Kneehills-Buffalo Lake | High | Aspen Parkland | 720 000 |
| 7. | Beaverhill-Mundare | High | Aspen Parkland | 285 200 |
| 8. | Viking Morraine | High | Aspen Parkland | 224 000 |
| 9. | Forestburg-Battle River | High | Aspen Parkland | 371 200 |
| 10. | Lloydminister-Ribstone | High | Aspen Parkland | 276 400 |
| 11. | Peace River Parkland | High | Aspen Parkland | 1 322 400 |
| 12. | Peace-Athabasca Delta | High | Boreal Forest | 377 600 |
| 13. | Gordon Lake | High | Boreal Forest | 11 380 |
| 14. | Jessie Lake | High | Boreal Forest | 324 |
| 15. | Hay-Zama lakes | High | Boreal Forest | 11 216 |
| 16. | Manawan Lake | High | Boreal Forest | 742 |
| 17. | Smoky Lake | High | Boreal Forest | 1 715 |
| 18. | Lesser Slave Lake | High | Boreal Forest | 3 312 |
| 19. | Big Lake | Medium | Boreal Forest | 1 715 |
| 20. | Lubicon Lake | Medium | Boreal Forest | 3 584 |
| 21. | Loon Lake | Medium | Boreal Forest | 1 460 |
| 22. | Cache Lake | Medium | Boreal Forest | 312 |
| 23. | Carroll lakes | Medium | Boreal Forest | 11 400 |
| 24. | Forsyth Lake | Medium | Boreal Forest | 380 |
| 25. | Cold Lake (S. Bays) | Medium | Boreal Forest | 2 160 |
| 26. | Little Buffalo Lake | Medium | Boreal Forest | 464 |
| 27. | Chip Lake | Medium | Boreal Forest | 7 347 |
| 28. | Utikuma Lake | Medium | Boreal Forest | 28 416 |
| 29. | Missawawi Lake | Medium | Boreal Forest | 2 560 |
| 30. | Therien lakes | Medium | Boreal Forest | 2 246 |
| 31. | Flat Lake | Medium | Boreal Forest | 3 072 |
| 32. | McClelland Lake | Medium | Boreal Forest | 2 745 |
| 33. | Bison Lake | Low | Boreal Forest | 3 226 |
| 34. | Lac la Biche | Low | Boreal Forest | 24 166 |
| 35. | Bistcho Lake | Low | Boreal Forest | 40 448 |
| | Grassland Total | | | 3 246 000 |
| | Aspen Parkland Total | | | 3 199 200 |
| | Boreal Forest Total | | | 540 815 |
| | Grand Total | | | 6 985 815 |

SOURCE: Adapted from: Migratory Bird Habitat Priorities, Prairie Provinces. Unpublished Report, June, 1979. Habitat Management Section, Canadian Wildlife Service, Edmonton. 104 pp.

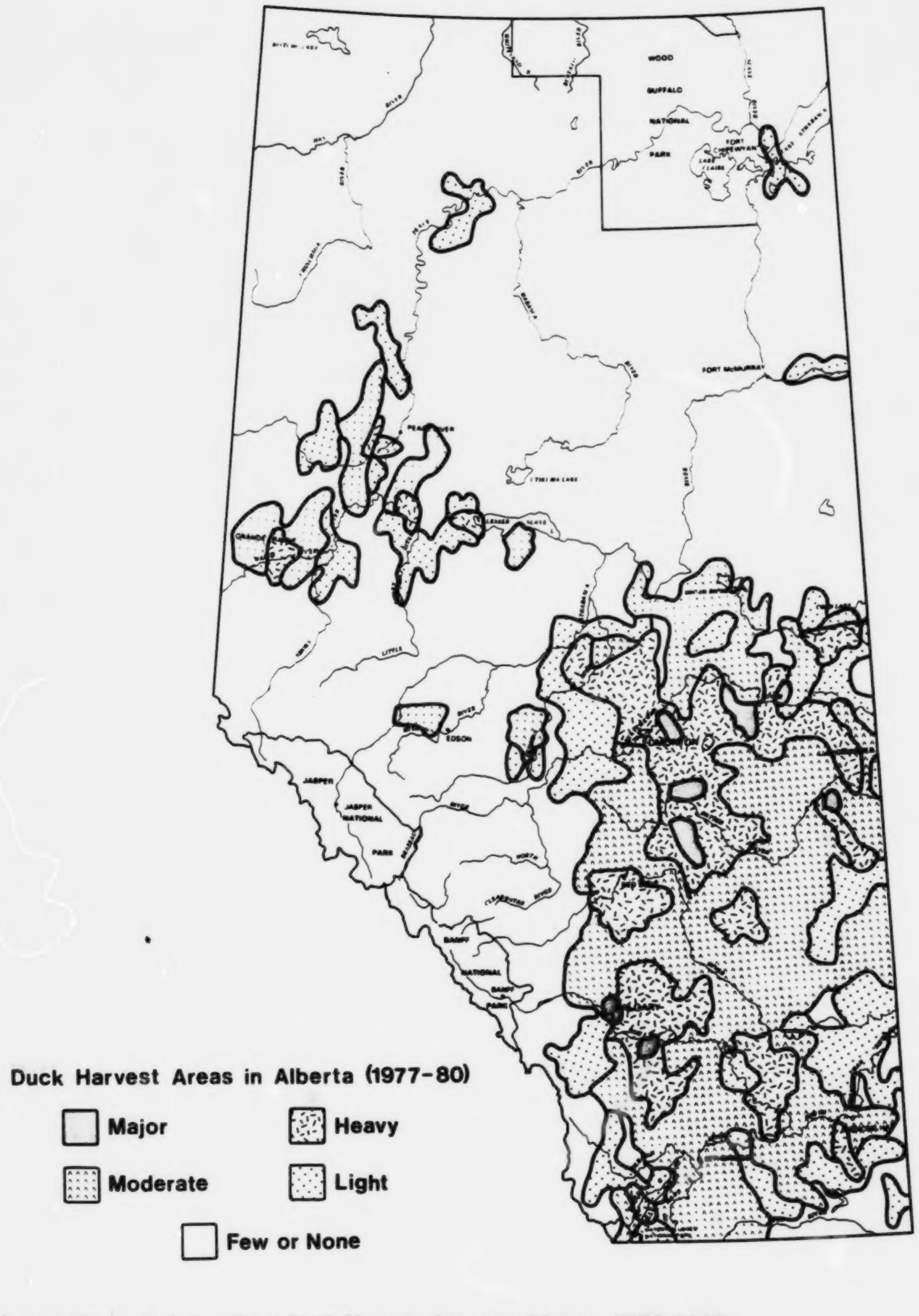

Figure 17.c: Relative Total Duck Harvest Areas in Alberta, 1977-1980.

SOURCE: Adapted from Technical Discussion Paper For Waterfowl Management in Alberta. Unpublished draft, May/85. Fish and Wildlife Division, ENR. Edmonton. 120 pp.

# CANADA GEESE

# 18. KEY HABITAT REQUIREMENTS FOR BREEDING CANADA GEESE

## 18.1 General

Canada geese (Branta canadensis) are the most adaptable of the goose species and breed locally in all parts of Alberta. They will nest wherever they can find a territory near water with a secure nest site, be it in northern forests, mountain valleys, or across prairies and parklands[3], though the most productive goose habitat is in the southeastern grassland zone.[5] Good breeding habitat provides a nesting site, feeding and brooding sites with adequate food and cover, all being in close proximity to an adequate water area.

The major Canada geese production areas and priority goose production habitat in Alberta are depicted in Figure 18 and Table 3.

## 18.2 Cover

### 18.2.1 Vegetation

Nest cover types include cattail (Typha latifolia), bulrushes (Scirpus sp.), grasses, annuals, shrubs[6] or some obstruction such as fallen trees.[2]

The type of cover is immaterial so long as the basic requirements for a nesting site (protection and isolation) are met.[26,30]

Nesting sites which are virtually inaccessible to mammalian predators (i.e. islands) may alleviate the necessity for nest concealment by emergent cover.[6,15]

Most nesting sites allow some visibility of the surrounding territory and easy access to water.[10]

Geese nesting in denser vegetation may be less vulnerable to competitive interactions with each other as this can lead to nest abandonment.[7]

Geese in southeastern Alberta selected artificial islands with a greater coverage of forbs and grasses, and islands with successful nests had denser vegetation than those with unsuccessful nests.[11] Tall or very dense growth, however, is not preferred.[30]

In southeastern Michigan, the density of vegetation at the immediate nest site was significantly lower than the average vegetation density on these same islands.[15]

Many forms of artificial nesting sites are accepted by Canada geese: artificial islands,[11] various nesting tubs,[4] cones, and platforms either in trees and poles, on the shore or in the water,[2] and on flax straw nesting bales.[14]

Nests are not elaborate. They are made from weeds, broken sticks, grass, moss, pine needles and other available materials; they are often a hollow scratched out of grasses and soil.[29]

Geese covering their nests with dead vegetation and down when leaving, may minimize the loss of eggs due to predation.[20]

Geese typically roost at night in marshes or open water in close proximity to grazing areas.[17,31]

Vegetation on grazing areas may be used as resting/loafing cover.[10]

During the moult, geese may seek safety in heavy, emergent shoreline vegetation such as bulrushes and cattails.[30]

### 18.2.2 Land Forms and Topography

Geese exhibit a preference for nesting on islands in rivers or lakes, though other sites such as isolated peninsulas, old heron and osprey nests, cliffs along rivers. Muskrat houses and beaver lodges are also used.[10,2,24] In marshy areas, muskrat houses may be the predominant nest site.[6,26]

Most nests on the Churchill River occurred on low profile islands.[23] Islands having more relief render nests less vulnerable to fluctuating water levels but facilitate nest vigilance due to decreased visibility.[15]

Islands within 46 m of the mainland or connected to the mainland at any time during the breeding season often attract predators.[2]

Smaller islands with a larger water-island interface tend to be preferred.[11,29]

Sandbars, mudflats, a clear shoreline or open water may be used for resting and loafing.[30]

Broods may return to nesting islands at night to roost.[12]

### 18.2.3 Aquatic Forms

Nesting pairs are frequently observed in association with large lakes or along streams.[21] Irrigation reservoirs and stock dams also are used if adequate nest sites are present.

Area of permanent, open water is a factor affecting the use of wetlands; in southeastern Michigan, > 90 per cent of all nests located had $\geq$ 2 ha of open water.[15]

Mosts nest sites are within a short distance of open water, < 2 m in southeastern Manitoba.[6]

In southeastern Alberta, geese selected islands with deeper surrounding water and those which were further from shore, thus reducing potential predation. These islands had higher nesting success than other areas.[11]

During moult, geese are rarely seen any distance from water, which is used for escape.[14]

### 18.2.4 Climate

Arrival of breeding geese in southern Alberta is related to the severity of winter and onset of spring snow melt.[12]

Extremely cold springs that delay the thawing of ice can dramatically decrease birds nesting in an area.[21]

Deep snow may force geese to abandon traditional nesting areas.[12]

Air temperature influences the rate of snow and ice melting, and thus may have an indirect as well as direct effect on the beginning of nesting.[6]

Shelter from prevailing winds may influence nest site selection.[22]

During cold periods, geese remain at roosting sites for much of the time.[17]

Extremely hot dry weather during nesting and cool wet weather during hatching and rearing may contribute to population decreases.[9]

## 18.3 Food

### 18.3.1 Vegetation

Geese are essentially grazing birds,[2] utilizing pastures, fields, marshes and lakes as feeding sites.

They consume a wide variety of grasses, rushes, cattail, forbs and submergent aquatic growth, ingesting leaves, shoots, roots and seeds.[3,6,19,30]

Geese also make use of grain crops such as wheat (Triticum sp.), barley (Hordeum sp.) and oats (Avena sativa) when available, during nesting, brooding and migration.[13,17]

Incubating females choose feeding sites having an abundance of new plant growth.[6]

Brood areas have a plentiful supply of aquatic or land vegetation.[10]

Goslings may consume insect and insect larvae but this lessens with age and constitutes a small part of the overall diet.[30]

### 18.3.2 Land Forms and Topography

Lake shores, mudflats, pastures and agricultural fields are used as feeding sites.

### 18.3.3 Aquatic Forms

Lakes, marshes, ponds and reservoirs provide aquatic feeding areas for geese.

Forage species, associated with aquatic areas include, spike rush (*Eleocharis* sp.), manna grass (*Glyceria* sp.), slough grass (*Beckmannia* sp.), cattail, arrowhead (*Sagittaria* sp.) and water plantain (*Alisma* sp.)[16,19]

Lowered water levels may adversely affect these feeding areas due to promotion of plant succession.[23]

### 18.3.4 Climate

Geese may not feed for several days during certain periods of cold weather, especially when accompanied by snow cover.[17]

Heavy snow which covers food resources, and cold temperatures which freeze roosting lakes in fall initiates southward migrations.[13]

### 18.3.5 Trace Elements

Geese consume small amounts of sand and gravel to assist the muscular gizzard in grinding hard foods.[30]

## 18.4 Space

### 18.4.1 Territory/Home Range

The Canada goose has a breeding ground home range.[6]

The territory of the Canada goose appears to be a moving territory centered around the female.[6] The size of the defended site varies with the density of the breeding population, age of the bird, the nature of the surrounding cover, available nesting space and the chronology of breeding.[3,1] It is smallest in the prelaying period and reaches a peak at clutch completion.[6]

Territoriality may act to space geese in an even pattern, though the heterogeneity of the vegetation may modify the pattern.[29]

On southeastern Alberta islands, territories located near the shore, where expanses of short grass and mud flats were present, were significantly larger than those located inland on the island where shrubs dominated.[7]

Larger territories may be less subjected to desertion as they may fulfil all the requirements of the nest site and also food and water.[7]

Both female and male actively protect nests.[3]

During nesting, geese generally have at least two feeding and two bathing sites.[6]

Close proximity between nesting and brooding areas is desirable.[2,28]

Movements of family groups may be inversely affected by group size.[17]

Once broods establish in a rearing area, they rarely move to other brood grounds.[10]

### 18.4.2 Population Densities

Factors affecting nesting density include: territoriality, available habitat, nest site tenacity,[6] age structure of the population[25] and vegetation density.

Nesting density is much higher on preferred sites (river and lake islands) than adjacent areas.[23]

On artificially created islands in southern Alberta, an average of 1.6 nests/ha (0.2-7.1 nests/ha) were supported.[11]

Small islands support a much greater nesting density than larger islands,[10,11,29] possibly due to a larger water-land interface.

In southeastern Alberta, greater nesting success was recorded for geese nesting singly on small islands.[11]

Large islands usually have more than one nesting pair.[11]

When islands are in short supply, high densities occur which may result in high losses through desertion.[7]

Distance between nest sites affects nesting success. In southeastern Alberta, successful nests were found to be an average of 14.9 m from neighboring nests.[7]

## 18.5 Special Considerations

### 18.5.1 Size, Shape and Juxtaposition of Habitat Components

Good breeding area should have grazing area available to nesting birds and to paired breeders prior to nesting, nesting sites which are isolated, have firm foundations and afford good visibility, a brooding area adjacent to open water with a grazing and/or an aquatic feeding area, and a cover of emergent plants for use during the moult and for roosting.[26,30]

Geese prefer to nest on smaller islands in relatively deep water.[11]

The degree of isolation of the nesting area determines the necessity for cover.[15]

The length of shoreline is considered important to nesting geese.[6]

Large territories which include feeding sites and water area, as well as nest site, are less likely to be deserted.[7]

### 18.5.2 Significance of Disturbance Phenomena

Flooding/Drainage. Flooding may result in nest destruction on a local basis.[6]

Potential hydroelectric developments in northern Alberta could pose a threat to boreal forest production habitat by flooding nesting islands and shorelines.[5]

Low water levels may also adversely affect the number of birds nesting.[21]

Human Disturbance. Canada geese will tolerate some human habitation when selecting nesting wetlands.[13]

Increased industrialization and recreation in northern Alberta may be a potential threat to some breeding areas.[5]

Brood shifts may occur in exceptionally dry years or in response to harassment by people and domestic animals.[28]

Agriculture. Much of the goose production habitat in southern Alberta is surrounded by agricultural pastures and fields. These areas are used as feeding sites during nesting and brooding.[18]

The development of artificial water bodies with suitable nest sites in southern Alberta may enhance goose utilization within the area.[18]

The drainage of wetland areas for agricultural expansion reduces waterfowl habitat.

## 18.6 Limiting Factors

Breeding Canada geese are limited by the availability of safe and isolated nesting sites, preferably on islands in lakes and rivers, with adequate feeding sites, cover and water area for nesting birds and broods.

The availability of nest sites is probably the main limiting factor on the prairies of Alberta as artificial nesting structures increase the breeding population.[11]

The strong homing instinct of Canada geese to particular breeding grounds is a limiting factor on their distribution.[1]

Low water levels during drought years may significantly decrease the number of nesting geese.[21]

Predation and nest desertion can cause substantial losses on a local basis.[6]

People's intolerance of crop depredation may also be a factor influencing the upper limits on Alberta's nesting flocks.[18]

## 18.7 Regional Variation

The major goose production habitat in Alberta occurs in the grassland zone and is designated as the Brooks-Lethbridge-Medicine Hat region.[5] The Stettler-Coronation-Drumheller region, in the southern part of the parkland vegetation zone, and the Peace River-parklands are the next most important goose production areas in the province.

Nesting concentrations of large Canada geese in southern Alberta have been located along major rivers and on islands in large, permanent water bodies.[8] Artificial water bodies and nesting sites are also used. Agricultural fields, which surround most of the goose nesting sites in southern Alberta, provide feeding areas. In the northern part of the province, most geese appear to nest on islands in major river systems.[8]

## ACKNOWLEDGMENTS

E. Hofman (Alberta Fish and Wildlife, Brooks), W. Wishart (Alberta Fish and Wildlife, Edmonton), and L. Shandruk (Can. Wildl. Ser., Edmonton) provided critical reviews and useful comments.

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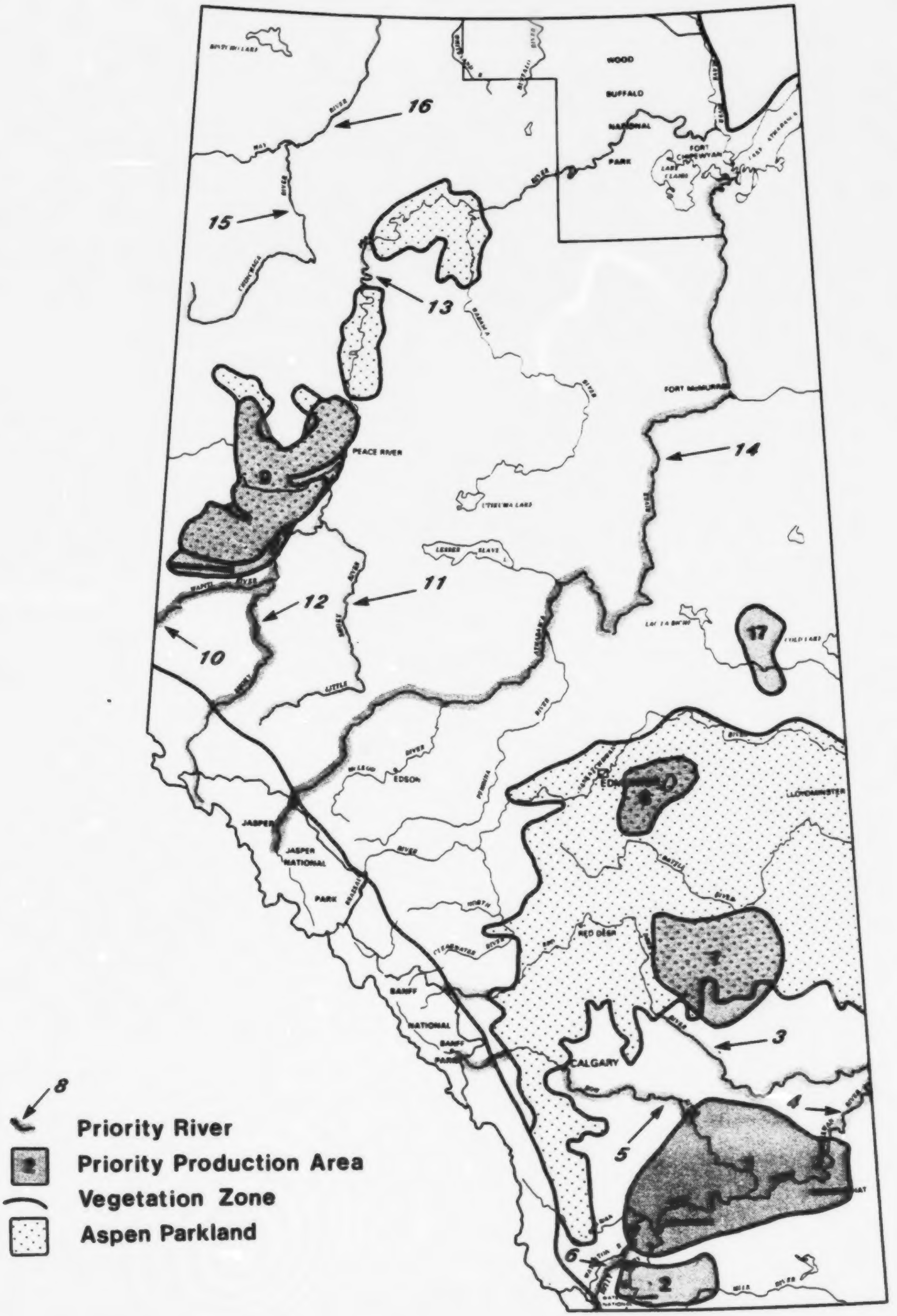

Figure 18. Priority Goose Production Habitat in Alberta.

SOURCE: Adapted from Migratory Bird Habitat Priorities; Prairie Provinces. Unpublished Report, June 1979. Canadian Wildlife Service. Edmonton. 104 pp.

## Table 3
## PRIORITY GOOSE PRODUCITON HABITAT IN ALBERTA
(refer to Figure 18)

| AREA NO. | NAME | PRIORITY | VEGETATION ZONE | SIZE (hectares) |
|---|---|---|---|---|
| 1. | Brooks-Lethbridge-Medicine Hat | High | Grasslands | 1 452 000 |
| 2. | Milk River Ridge | High | Grasslands | 344 000 |
| 3. | Red Deer River | High | Grasslands | 38 800 |
| 4. | South Saskatchewan River | High | Grasslands | 92 000 |
| 5. | Bow River | High | Grasslands | 39 080 |
| 6. | Oldman River | High | Grasslands | 19 000 |
| 7. | Stettler-Coronation-Drumheller | Medium | Aspen Parkland | 808 000 |
| 8. | Cooking Lake Moraine | Medium | Aspen Parkland | 72 000 |
| 9. | Peace River Parkland | Medium | Aspen Parkland | 1 322 500 |
| 10. | Wapiti River | Medium | Boreal Forest | 4 800 |
| 11. | Little Smoky River | Medium | Boreal Forest | 3 400 |
| 12. | Smoky River | medium | Boreal Forest | 1 500 |
| 13. | Peace River | Medium | Boreal Forest | 154 000 |
| 14. | Athabasca River | Medium | Boreal Forest | 111 200 |
| 15. | Chinchaga River | Medium | Boreal Forest | 1 640 |
| 16. | Hay River | Medium | Boreal Forest | 3 440 |
| 17. | Stebing-Forsyth-Manatokan lakes | Low | Boreal Forest | 74 000 |
|  | Grassland Total |  |  | 1 984 880 |
|  | Aspen Parkland Total |  |  | 2 202 400 |
|  | Boreal Forest Total |  |  | 353 980 |
|  | Grand Total |  |  | 4 541 260 |

SOURCE: Adapted from: Migratory Bird Habitat Priorities, Prairie Provinces. Unpublished Report, June, 1979. Habitat Management Section, Canadian Wildlife Service, Edmonton. 104pp.

# MOULTING, STAGING, AND MIGRANT WATERFOWL

# 19. KEY HABITAT REQUIREMENTS FOR MOULTING, STAGING, AND MIGRANT WATERFOWL

## 19.1 General

Alberta serves as a moulting, stopover, and staging area for vast numbers of migrating waterfowl primarily from the Pacific and Central flyways, thus having national and international significance as a migratory corridor. Larger marshes and lakes with stable water levels, providing abundant food, adequate cover, isolation, and resting sites are preferred areas for staging and moulting. A greater variety of water bodies are associated with stopover sites, their use being less predictable. The magnitude of the migratory population and seasonal phenology, as well as habitat suitability, influence the use of these areas.

The distribution of priority moulting and staging areas for ducks and geese in Alberta are given on the accompanying maps (Maps 19.a - 19.d) and Tables 4 - 7.

## 19.2 Cover

### 19.2.1 Vegetation

On spring-staging areas at the Peace-Athabasca Delta edge, types preferred by dabblers were mud flats, meadow, immature fen and emergent vegetation; divers preferred emergent, tall shrub, meadow and low shrub edges, and geese preferred mud flats and immature fen.[9]

On fall-staging areas, dabblers preferred mud flats, immature fen and emergent shorelines; divers preferred emergent areas of restricted-drainage lakes and open, deep streams; geese preferred emergents and open drainage immature fen, and mud flats.[9]

Geese and swans do not prefer lakes that are heavily forested.[12]

Shoreline resting areas were found to be close to dense expanses of taller emergents such as hard-stem bulrush (Scirpus sp.) and cattail (Typha latifolia) in southeastern Manitoba.[5]

Emergent vegetation is used as roosting cover by dabblers and geese.[16,20]

Marginal-emergent shorelines of open-drainage lakes and marshes appear to be the preferred moulting areas for dabblers;[9] when disturbed they favor the zone of emergent vegetation.[16,22]

Diving ducks, during the moult, may use marshy inlets for security though they seldom move onto land.[16]

### 19.2.2 Land Forms and Topography

Shoreline resting areas include mud or gravel points, mud bars, or the shores of small bays, inlets, and islands.[5]

When on water, birds may use landforms such as islands as visual obstructions to potential danger.[11]

### 19.2.3 Aquatic Forms

Large lakes serve primarily as staging, moulting and migration areas.

Shallow lakes and sloughs with stable water levels provide good stopover habitat for dabbling ducks; larger and deeper lakes are suitable stopover habitat for diving ducks.[15,16,22]

During the moult, diving ducks and geese use water as an escape medium.[16]

As lakes freeze-up, a greater number of waterfowl use rivers.[22]

### 19.2.4 Climate

Length of stay at stopover and staging areas may depend on local weather conditions.

Advance of spring migration progresses fairly slowly in response to northern climates[3,22] and early use of water areas generally follows the sequence of spring break-up.[22]

Fall migration is more rapid, with many birds waiting until freeze-up or low temperatures before suddenly moving south.[3]

Dry weather may decrease the areas available as stopover sites.

## 19.3 Food

### 19.3.1 Vegetation

Dabbling ducks, geese, and swans feed on a variety of emergent, and submergent plants including pondweeds (Potamogeton sp.), duckweed (Lemna sp.), bulrushes, sedges (Carex sp.) and smartweed (Polygonum sp.).[1, 2,7,14,17]

Diving ducks feed more frequently on submerged plants (pondweeds), and animal foods are more important to diving ducks than most dabblers.[1,2,7,14]

Geese also utilize a variety of pasture grasses and grains.[2,13]

Moulting and staging birds may be attracted to sites with an extensive food resource.[8,10,18]

Movement of males and nonbreeders to moulting areas may be an adaption to reduce competition for food on breeding areas.[18]

Although large concentrations of different species of birds may use a given moulting or staging area, competition for food can be reduced by differences between species in foods eaten, feeding habitat and feeding behavior.[8]

When wing moult is complete, mallards, pintails and geese may feed extensively in grain stubble fields, utilizing wheat, barley, oats and corn.[5,13,3]

### 19.3.2 Land Forms and Topography

Mud flats, lake shores, marsh shores, pastures and fields provide potential foraging areas.

### 19.3.3 Aquatic Forms

Lakes, marshes, sloughs and rivers are aquatic feeding sites.

During spring migrations, freshly thawed lakes with their abundance of food are preferred over rivers.[22]

Waterfowl tend to feed on the shore and along the shore during pre-moult and post-moult, and in open water during moulting where they are less accessible to predation.[16]

Aquatic feeding may be concentrated where local abundance of food occurs.[4]

Animal matter in the diets of divers and dabblers include aquatic insects, amphipods and gastropods.[1,2,7,14,17]

Mergansers consume mainly fish.[23]

### 19.3.4 Climate

The progression of spring break-up and fall freeze-up influences the use of aquatic feeding areas.[22]

Weather significantly influences distance flown to feeding areas. During periods of low temperature, precipitation or cloudy conditions with moderate to heavy winds, ducks feed in close proximity to the staging water body;[5] geese tend to be more tolerant to weather conditions and continue to feed at preferred sites (e.g. grain fields).[5]

When snow covers waste grain in harvested fields to the extent that it makes for difficulty in the feeding activity of mallards and pintails, migrations may occur.[3]

### 19.3.5 Trace Elements

Grit particles are usually consumed to assist the grinding of food particles in the gizzard.[16]

## 19.4 Space

### 19.4.1 Territory/Home Range

Alberta's wetlands act as a corridor for waterfowl migrating to northern breeding grounds and southern wintering areas.[3]

Large bodies of water attract migrating waterfowl, influencing their flight pattern.[22,24]

Birds may move short distances, or hundreds of miles to moulting and staging areas.[3,16,24]

The distance waterfowl move between stopover and staging areas is variable with species, available habitat, and weather conditions as well as condition of the bird.[3,22]

Stopover and staging areas may serve as extensions of the wintering areas; abundant food supplies may hold large populations at northern latitudes during mild weather.[8]

### 19.4.2 Population Densities

Moulting populations include post-breeding and non-breeding resident birds, immigrants from surrounding lakes and marshes, and immigrants from considerable distances.[9]

Moulting densities on the Peace-Athabasca Delta were 0-74.0/ha for dabblers and 0-32.0/ha for divers.[9]

Population densities for spring and fall-staging waterfowl are influenced by the availability of specific habitat types, the magnitude of the continental waterfowl population, the nesting success of the northern breeding population and the seasonal phenology.[9]

Spacial distribution of ducks, geese and swans is variable depending on the water body, its size and depth, food resources and weather conditions, often resulting in concentrations on sections of some lakes.[12]

The density of spring-staging waterfowl in the Peace-Athabasca Delta area ranged from 0 to 140 ducks/km of sampled shoreline in 1971 (means = 1.8 for divers, 17.5 for dabblers).[9]

On sampled areas of the Peace-Athabasca Delta for 1971, the mean densities of fall-staging waterfowl ranged from 1.2 to 709.6/km of shoreline for dabblers, 0 to 65.2/km for geese and swans, and 0.07 to 0.49/ha for divers.[9]

## 19.5 Special Considerations

### 19.5.1 Size, Shape and Juxtaposition of Habitat Components

Large bodies of water or water body complexes with abundant food resources attract migrant, moulting and staging waterfowl.

The extent of shoreline development and the diversity of shoreline vegetation types, as well as water depth, will influence the types and numbers of waterfowl accommodated.[10]

Local topography and juxtaposition to other water bodies are features which may attract waterfowl.[9]

Moulting and staging areas may or may not be synonomous.

### 19.5.2 Significance of Disturbance Phenomena

Agriculture. Intensified agriculture and drainage are depleting staging and stopover habitat in the parkland.[6]

A decline in natural wetlands along migration corridors results in a greater concentration of waterfowl on many stopover areas. Concentrating waterfowl may result in a more rapid depletion of food resources.[8]

Human Disturbance. Hunting pressure influences use of feeding sites and water areas.[5]

Increased recreational use, hydroelectric developments and increased industrialization may threaten staging habitat in northern Alberta.[6]

Floods/Water Levels. Flood conditions can have a marked effect upon waterfowl use. Traditional feeding or loafing areas may be temporarily lost, causing earlier than usual departure.[21]

Low fall water levels may provide extensive, mudflat-type shoreline, especially on larger lakes; this may attract a large, fall-staging population.[10]

## 19.6 Limiting Factors

Staging and moulting areas are limited by the distribution of larger water bodies with stable water levels, adequate shoreline types, food supply and cover.[11,16,18]

Available dry edge may be a limiting factor of staging areas.[9]

Food resource and number of birds using it influences length of stay.[8]

The timing of weather conditions, spring thaw and fall freeze-up also limits the use of staging and stopover areas.[22]

Agricultural, recreational, and industrial developments may decrease habitat available for moulting, staging and migrant waterfowl.[6]

## 19.7 Regional Variations

Staging habitat for ducks is concentrated mainly in the central regions of both the grassland and the aspen parkland zones of the province.[6] These areas serve as staging sites for birds produced locally and for those from northern areas. Sites scattered throughout the boreal forest zone are also important, especially for waterfowl moving down from the Arctic. The majority of known duck moulting areas are located in the boreal forest vegetation zone, though several lakes in the parklands are also important. Boreal forest areas may provide isolation and abundant food resources required for moulting.

The major goose staging habitat is located in the aspen parkland and grassland zones, the southern sections of these zones being utilized the longest by staging Canada geese as water areas remain open the longest here.[6] Arctic migrants such as the lesser Canada geese, snow geese, Ross' geese, and white-fronted geese also make partial use of these areas for fall-staging. In the boreal forest vegetation zone, the Peace-Athabasca Delta and the Hay-Zama lakes are important staging areas for arctic migrants.[6,19]

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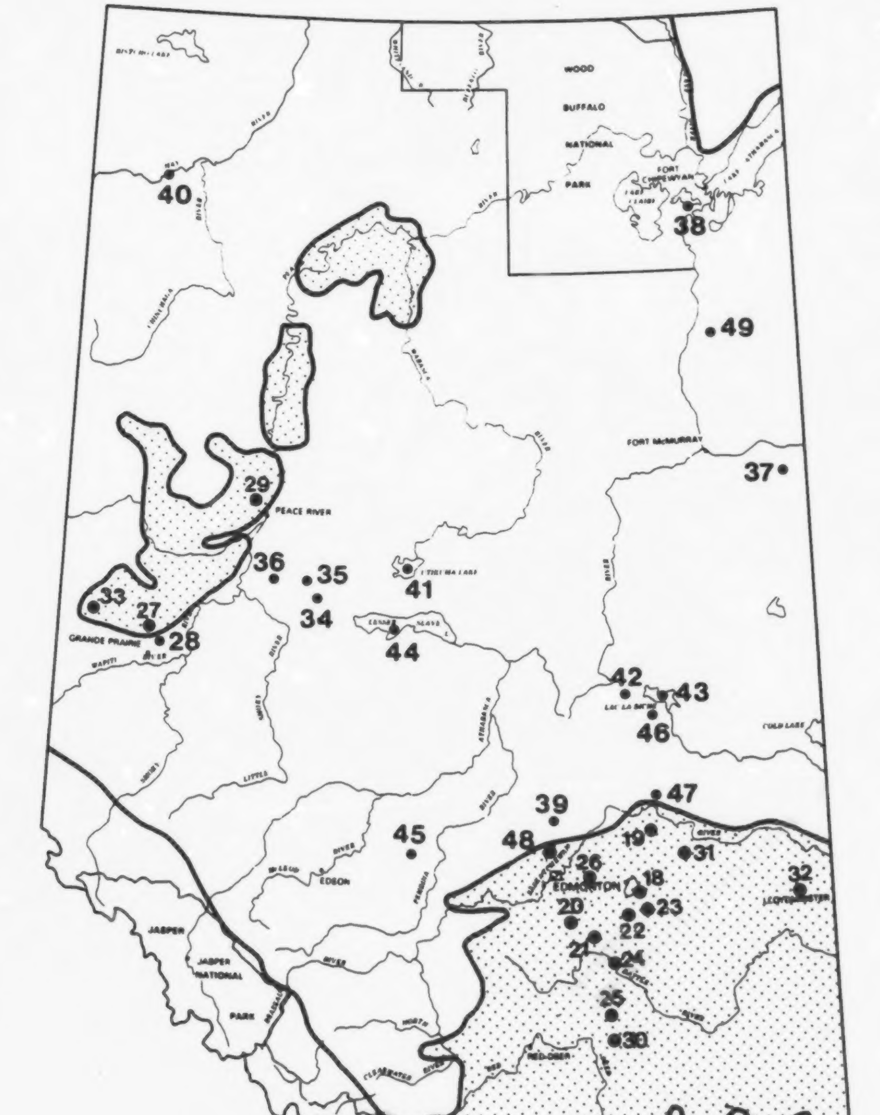

Figure 19.a: Priority Duck Staging Habitat in Alberta.

SOURCE: Adapted from Migratory Bird Habitat Priorities; Prairie Provinces. Unpublished Report, June 1979. Canadian Wildlife Service. Edmonton. 104 pp.

Table 4
PRIORITY DUCK STAGING HABITAT IN ALBERTA
(refer to Figure 19a)

| AREA NO. | NAME | PRIORITY | VEGETATION ZONE | SIZE (hectares) |
|---|---|---|---|---|
| 1. | Murray Lake | High | Grassland | 1 690 |
| 2. | Frank Lake | High | Grassland | 1 200 |
| 3. | Pakowki Lake | High | Grassland | 13 184 |
| 4. | Louisiana Lakes | High | Grassland | 1 490 |
| 5. | Many Island Lake | Medium | Grassland | 8 960 |
| 6 | McGregor Reservoir | Medium | Grassland | 5 043 |
| 7. | Stirling Lake | Medium | Grassland | 102 |
| 8. | Keho Lake | Medium | Grassland | 1 843 |
| 9. | Bassano Reservoir | Medium | Grassland | 640 |
| 10. | Stobart Lake | Medium | Grassland | 496 |
| 11. | Crow Indian Lake | Medium | Grassland | 1 000 |
| 12. | Red Deer River | Medium | Grassland | 38 800 |
| 13. | South Saskatchewan River | Medium | Grassland | 92 000 |
| 14. | Oldman River | Medium | Grassland | 19 000 |
| 15. | Bow River | Medium | Grassland | 39 080 |
| 16. | Travers Reservoir | Low | Grassland | 2 227 |
| 17. | Lake Newell | Low | Grassland | 5 990 |
| 18. | Beaverhill Lake | High | Aspen Parkland | 13 670 |
| 19. | Whitford Lake | High | Aspen Parkland | 1 820 |
| 20. | Big Hay Lake | High | Aspen Parkland | 1 075 |
| 21. | Bittern Lake | High | Aspen Parkland | 2 714 |
| 22. | Demay Lake | High | Aspen Parkland | 717 |
| 23. | Dusty Lake | High | Aspen Parkland | 384 |
| 24. | Driedmeat Lake | High | Aspen Parkland | 1 075 |
| 25. | Buffalo Lake | High | Aspen Parkland | 10 354 |
| 26. | Cooking Lake | High | Aspen Parkland | 3 456 |
| 27. | Bear Lake | High | Aspen Parkland | 3 098 |
| 28. | Saskatoon Lake | High | Aspen Parkland | 589 |
| 29. | Cardinal Lake | High | Aspen Parkland | 4 378 |
| 30. | Erskine Lake | High | Aspen Parkland | 1 500 |
| 31. | Bens-Watt lakes | Medium | Aspen Parkland | 256 |
| 32. | Kenilworth Lake | Medium | Aspen Parkland | 658 |
| 33. | Lac La Glace | Medium | Aspen Parkland | 896 |
| 34. | Winagami Lake | Medium | Aspen Parkland | 4 248 |
| 35. | Kimiwan Lake | Medium | Aspen Parkland | 3 854 |
| 36. | Lac Maglorie | Medium | Aspen Parkland | 818 |

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Table 4
Continued ...

| AREA NO. | NAME | PRIORITY | VEGETATION ZONE | SIZE (hectares) |
|---|---|---|---|---|
| 37. | Gordon Lake | High | Boreal Forest | 11 392 |
| 38. | Peace-Athabasca Delta | High | Boreal Forest | 377 600 |
| 39. | Manawan Lake | High | Boreal Forest | 742 |
| 40. | Hay-Zama lakes | High | Boreal Forest | 11 216 |
| 41. | Utikuma Lake | Medium | Boreal Forest | 28 416 |
| 42. | Flat Lake | Medium | Boreal Forest | 3 072 |
| 43. | Lac La Biche | Medium | Boreal Forest | 24 166 |
| 44. | Lesser Slave Lake | Medium | Boreal Forest | 45 312 |
| 45. | Chip Lake | Medium | Boreal Forest | 7 347 |
| 46. | Missawawi Lake | Medium | Boreal Forest | 2 560 |
| 47. | Smoky Lake | Medium | Boreal Forest | 540 |
| 48. | Big Lake | Medium | Boreal Forest | 1 715 |
| 49. | McClelland Lake | Low | Boreal Forest | 2 745 |
|  | Grassland Total |  |  | 232 745 |
|  | Aspen Parkland Total |  |  | 55 560 |
|  | Boreal Forest Total |  |  | 516 823 |
|  | Grand Total |  |  | 805 128 |

SOURCE: Adapted from: Migratory Bird Habitat Priorities, Prairie Provinces. Unpublished Report, June, 1979. Habitat Management Section, Canadian Wildlife Service. Edmonton. 104 pp.

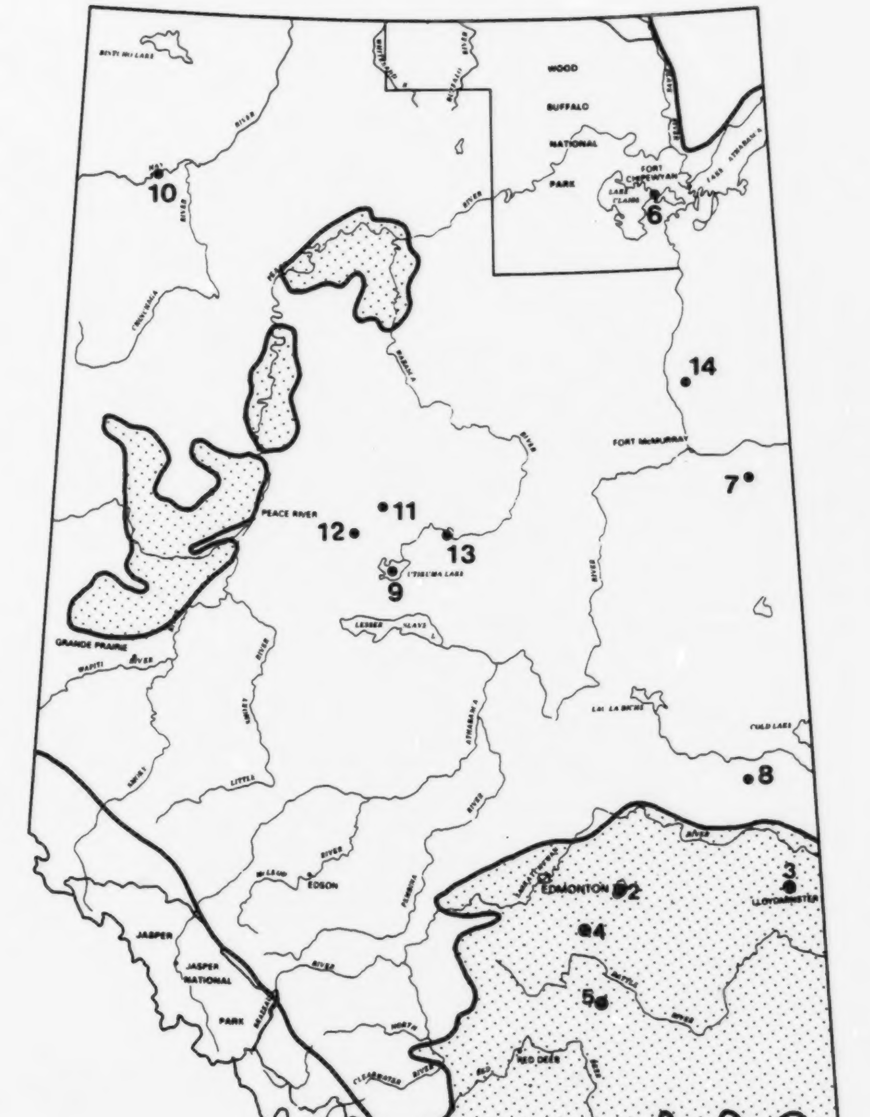

Figure 19.b: Priority Duck Moulting Habitat in Alberta.

SOURCE: Adapted from Migratory Bird Habitat Priorities; Prairie Provinces. Unpublished Report, June 1979. Canadian Wildlife Service. Edmonton. 104 pp.

## Table 5
## PRIORITY DUCK MOULTING HABITAT IN ALBERTA
(refer to Figure 19b)

| AREA NO. | NAME | PRIORITY | VEGETATION ZONE | SIZE (hectares) |
|---|---|---|---|---|
| 1. | Murray Lake | Medium | Grassland | 1 690 |
| 2. | Beaverhill Lake | High | Aspen Parkland | 14 800 |
| 3. | Kenilworth Lake | Medium | Aspen Parkland | 666 |
| 4. | Bittern Lake | Medium | Aspen Parkland | 2 714 |
| 5. | Buffalo Lake | Medium | Aspen Parkland | 10 354 |
| 6. | Peace-Athabasca Delta | High | Boreal Forest | 377 600 |
| 7. | Gordon Lake | High | Boreal Forest | 11 392 |
| 8. | Jessie Lake | High | Boreal Forest | 296 |
| 9. | Utikima Lake | Medium | Boreal Forest | 28 416 |
| 10. | Hay-Zama lakes | Medium | Boreal Forest | 11 216 |
| 11. | Loon Lake | Medium | Boreal Forest | 1 472 |
| 12. | Lubicon Lake | Medium | Boreal Forest | 3 506 |
| 13. | Muskwa Lake | Medium | Boreal Forest | 4 813 |
| 14. | McClelland Lake | Low | Boreal Forest | 2 745 |
|  | Grassland Total |  |  | 1 690 |
|  | Aspen Parkland Total |  |  | 28 534 |
|  | Boreal Forest Total |  |  | 441 456 |
|  | Grand Total |  |  | 471 680 |

SOURCE: Adapted from: Migratory Bird Habitat Priorities; Prairie Provinces. Unpublished Report, June, 1979. Habitat Management Section, Canadian Wildlife Service. Edmonton. 104 pp.

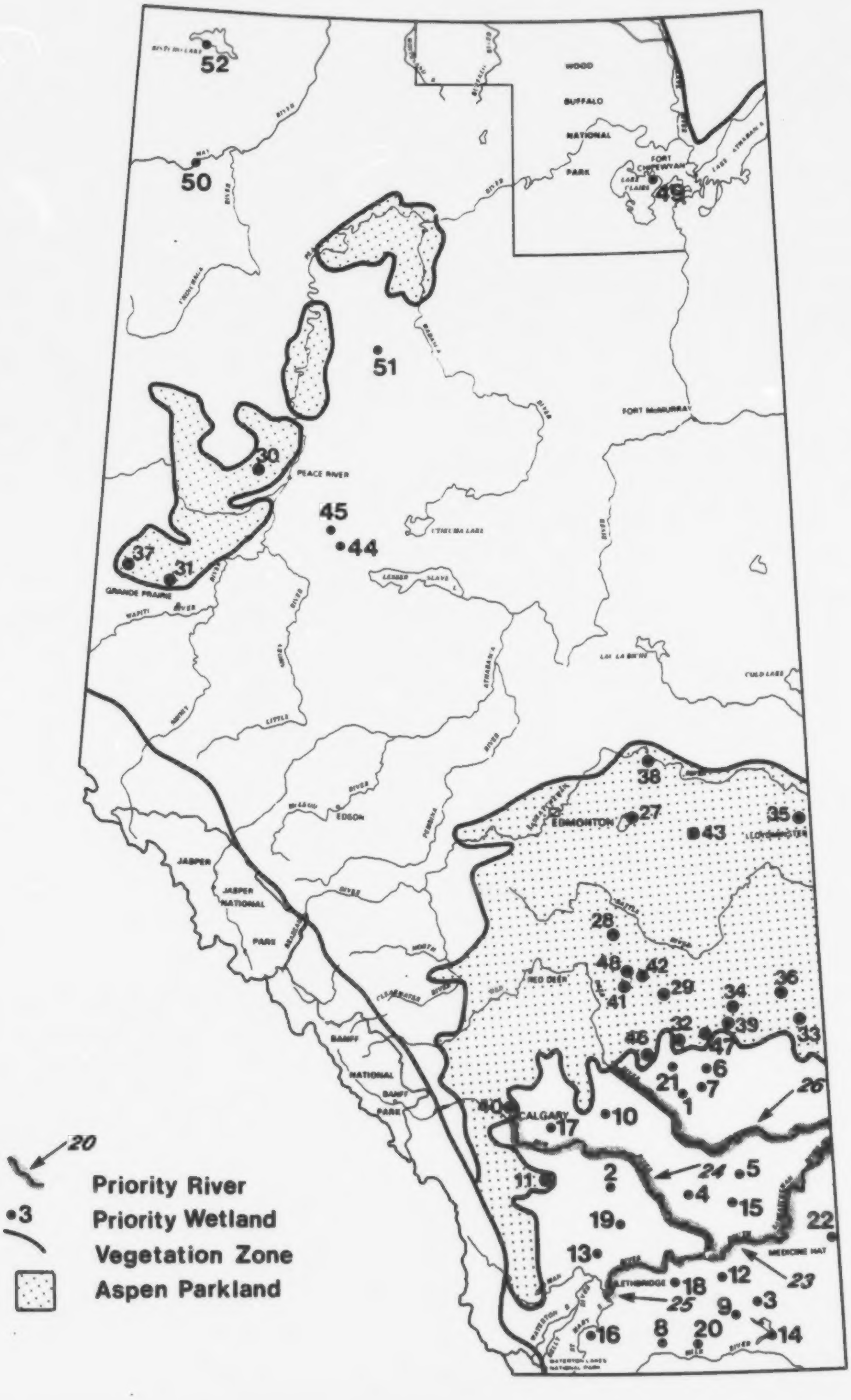

Figure 19.c: Priority Goose Staging Habitat in Alberta.

SOURCE: Adapted from Migratory Bird Habitat Priorities; Prairie Provinces. Unpublished Report, June 1979. Canadian Wildlife Service. Edmonton. 104 pp.

## Table 6
## PRIORITY GOOSE STAGING HABITAT IN ALBERTA
(refer to Figure 19c)

| AREA NO. | NAME | PRIORITY | VEGETATION ZONE | SIZE (hectares) |
|---|---|---|---|---|
| 1. | Berry Creek Reservoir | High | Grassland | 589 |
| 2. | McGregor Reservoir | High | Grassland | 5 043 |
| 3. | Murray Lake | High | Grassland | 1 690 |
| 4. | Lake Newell | High | Grassland | 5 990 |
| 5. | Louisiana Lakes | High | Grassland | 1 490 |
| 6. | Plover Lake | High | Grassland | 256 |
| 7. | Birkshire Reservoir | High | Grassland | 240 |
| 8. | Milk River Ridge Reservoir | High | Grassland | 1 797 |
| 9. | Crow Indian Lake | Medium | Grassland | 1 000 |
| 10. | Deadhorse Lake | Medium | Grassland | 1 229 |
| 11. | Frank lake | Medium | Grassland | 1 997 |
| 12. | Grassy Lake | Medium | Grassland | 230 |
| 13. | Keho Lake | Medium | Grassland | 1 843 |
| 14. | Pakowki Lake | Medium | Grassland | 13 076 |
| 15. | Scots Reservoir | Medium | Grassland | 205 |
| 16. | St. Mary's Reservoir | Medium | Grassland | 4 608 |
| 17. | Stobart Lake | Medium | Grassland | 496 |
| 18. | Taber Lake | Medium | Grassland | 461 |
| 19. | Travers Reservoir | Medium | Grassland | 2 227 |
| 20. | Verdigris Lake | Medium | Grassland | 691 |
| 21. | Colemen Lake | Medium | Grassland | 1 070 |
| 22. | Many Island Lake | Medium | Grassland | 8 960 |
| 23. | South Saskatchewan River | Low | Grassland | 92 000 |
| 24. | Bow River | Low | Grassland | 39 080 |
| 25. | Oldman River | Low | Grassland | 19 000 |
| 26. | Red Deer River | Low | Grassland | 38 800 |
| 27. | BeaverHill Lake | High | Aspen Parkland | 13 670 |
| 28. | Buffalo Lake | High | Aspen Parkland | 10 354 |
| 29. | Sullivan Lake | High | Aspen Parkland | 10 854 |
| 30. | Cardinal Lake | High | Aspen Parkland | 4 378 |
| 31. | Bear Lake | High | Aspen Parkland | 3 098 |
| 32. | Dowling Lake | High | Aspen Parkland | 2 918 |
| 33. | Grassy Island Lake | High | Aspen Parkland | 1 101 |
| 34. | Kirkpatrick lake | High | Aspen Parkland | 1 638 |
| 35. | Kenilworth Lake | Medium | Aspen Parkland | 438 |
| 36. | Sounding Lake | Medium | Aspen Parkland | 3 789 |
| 37. | Lac La Glace | Medium | Aspen Parkland | 896 |
| 38. | Whitford Lake | Medium | Aspen Parkland | 1 920 |
| 39. | Antelope Lake | Medium | Aspen Parkland | 282 |
| 40. | Eagle Lake | Medium | Aspen Parkland | 1 306 |

Continued next page ...

Table 6
Continued ...

| AREA NO. | NAME | PRIORITY | VEGETATION ZONE | SIZE (hectares) |
|---|---|---|---|---|
| 41. | Gough Lake | Medium | Aspen Parkland | 4 864 |
| 42. | Shooting Lake | Medium | Aspen Parkland | 794 |
| 43. | Birch Lake | Medium | Aspen Parkland | 2 473 |
| 44. | Winagami Lake | Medium | Aspen Parkland | 4 248 |
| 45. | Kimiwan Lake | Medium | Aspen Parkland | 3 854 |
| 46. | Handhills Lake | Medium | Aspen Parkland | 803 |
| 47. | Contracosta Lake | Medium | Aspen Parkland | 695 |
| 48. | Marion Lake | Low | Aspen Parkland | 1 971 |
| 49. | Peace-Athabasca Delta | High | Boreal Forest | 377 600 |
| 50. | Hay-Zama lakes | High | Boreal Forest | 11 216 |
| 51. | Bison Lake | High | Boreal Forest | 3 226 |
| 52. | Bistcho Lake | Medium | Boreal Forest | 40 448 |
| | Grassland Total | | | 244 068 |
| | Aspen Parkland Total | | | 76 344 |
| | Boreal Forest Total | | | 432 490 |
| | Grand Total | | | 752 902 |

SOURCE: Adapted from: Migratory Bird Habitat Priorities, Prairie Provinces. Unpublished Report, June, 1979. Habitat Management Section, Canadian Wildlife Service. Edmonton. 104pp.

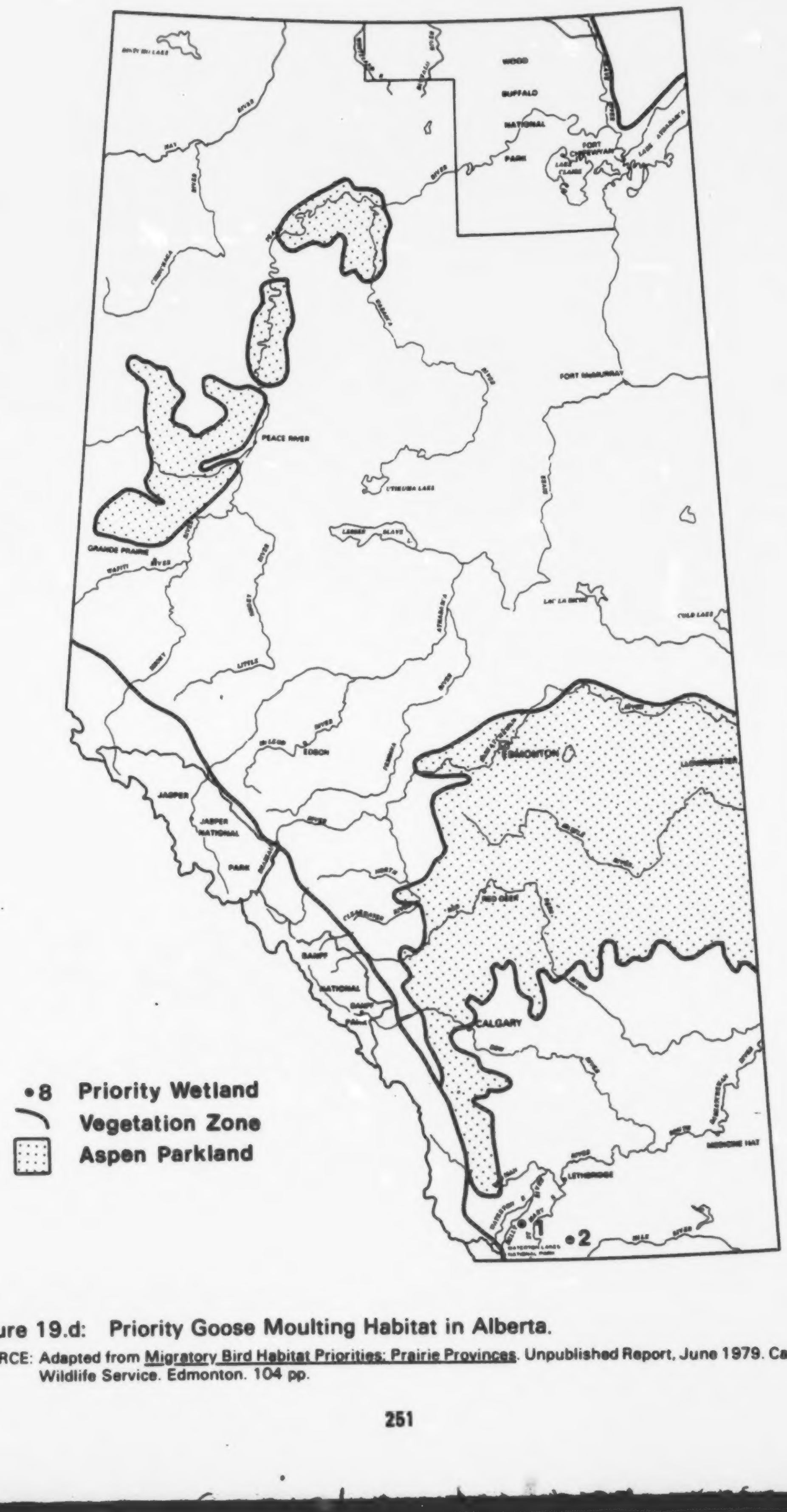

Figure 19.d: Priority Goose Moulting Habitat in Alberta.

SOURCE: Adapted from Migratory Bird Habitat Priorities: Prairie Provinces. Unpublished Report, June 1979. Canadian Wildlife Service. Edmonton. 104 pp.

### Table 7
### PRIORITY GOOSE MOULTING HABITAT IN ALBERTA
(refer to Figure 19d)

| AREA NO. | NAME | PRIORITY | VEGETATION ZONE | SIZE (hectares) |
|---|---|---|---|---|
| 1. | Knight Ranch Reservoir | High | Grassland | 188 |
| 2. | Ross Lake | High | Grassland | 235 |
|  | Other major goose production lakes have resident moulting birds. |  |  |  |
|  |  |  | TOTAL | 423 |

SOURCE: Adapted from: Migratory Bird Habitat Priorities, Prairie Provinces. Unpublished Report, June, 1979. Habitat Management Section, Canadian Wildlife Service. Edmonton. 104 pp.

## APPENDIX 1
## COMMON AND SCIENTIFIC NAMES OF MAMMLAS REFERRED TO IN TEXT

| COMMON NAME | SCIENTIFIC NAME |
|---|---|
| bighorn sheep | *Ovis canadensis* |
| elk | *Cervus elaphus* |
| moose | *Alces alces* |
| mountain goat | *Oreamnos americanus* |
| mule deer | *Odocoileus hemionus* |
| pronghorn antelope | *Antilocapra americana* |
| white-tailed deer | *Odocoileus virginianus* |
| woodland/mountain caribou | *Rangifer tarandus caribou* |
| | |
| beaver | *Castor canadensis* |
| grizzly bear | *Ursus arctos* |
| ground squirrel | *Spermophilus* sp. |
| marten | *Martes americana* |
| meadow vole | *Microtus pennsylvanicus* |
| mink | *Mustela vison* |
| muskrat | *Ondatra zibethicus* |
| river otter | *Lutra canadensis* |
| red squirrel | *Tamiasciurus hudsonicus* |
| red-backed vole | *Clethrionomys gapperi* |
| snowshoe hare | *Lepus americanus* |
| weasel | *Mustela* sp. |

## APPENDIX 2
## COMMON AND SCIENTIFIC NAMES OF BIRDS REFERRED TO IN TEXT

| COMMON NAMES | SCIENTIFIC NAMES |
|---|---|
| Waterfowl | |
| American wigeon | *Mareca americana* |
| blue-winged teal | *Anas discors* |
| Canada goose | *Branta canadensis* |
| gadwall | *Anas streperus* |
| green-winged teal | *Anas crecca* |
| mallard | *Anas platyrhynchos* |
| northern shoveler | *Spatula clypeata* |
| pintail | *Anas acuta* |
| Upland Game Birds | |
| ring-necked pheasant | *Phasianus colchicus* |
| sage grouse | *Centrocercus urophasianus urophasianus* |
| sharp-tailed grouse | *Pedioecetes phasianellus* |

# APPENDIX 3

## COMMON AND SCIENTIFIC NAMES OF PLANTS REFERRED TO IN TEXT (ALBERTA SPECIES TAKEN FROM E.H. MOSS, FLORA OF ALBERTA)

| COMMON NAMES | SCIENTIFIC NAMES |
|---|---|
| Trees/Shrubs | |
| alder | *Alnus* sp. |
| alpine fir | *Abies lasiocarpa* |
| alpine larch | *Larix lyallii* |
| aspen | *Populus tremuloides* |
| balsam poplar | *Populus balsamifera* |
| bearberry | *Arctostaphylos uva-ursi* |
| beaked hazelnut | *Corylus cornuta* |
| birch | *Betula* sp. |
| bitterbrush | *Purshia tridentata* |
| black spruce | *Picea mariana* |
| blueberry | *Vaccinium* |
| bog birch | *Betula pumila* |
| buckbrush | *Symphoricarpos occidentalis* |
| buffaloberry | *Shepherdia canadensis* |
| choke cherry | *Prunus virginiana* |
| clematis | *Clematis* sp. |
| cottonwood | *Populus balsamifera* |
| creeping juniper | *Juniperus horizontalis* |
| currant | *Ribes* sp. |
| Douglas fir | *Pseudotsuga menziesii* |
| dwarf birch | *Betula glandulosa* |
| Engelmann spruce | *Picea engelmannii* |
| fir | *Abies* sp. |
| gooseberry | *Ribes* sp. |
| hawthorn | *Crataegus* sp. |
| high-bush cranberry | *Viburnum trilobum* |
| honeysuckle | *Lonicera* sp. |
| huckleberry | *Vaccinium membranaceum* |
| jackpine | *Pinus banksiana* |
| juniper | *Juniperus* sp. |

# APPENDIX 3
Continued ...

| COMMON NAMES | SCIENTIFIC NAMES |
|---|---|
| **Trees/Shrubs** | |
| lodgepole pine | Pinus contorta |
| low-bush cranberry | Viburnum edule |
| mountain ash | Sorbus aucuparia |
| mountain maple | Acer glabrum |
| paper birch | Betula papyrifera |
| pin cherry | Prunus pensylvanica |
| pine | Pinus sp. |
| rabbit brush | Chrysothamous nauseosus |
| raspberry | Ribes sp. |
| red osier dogwood | Cornus stolonifera |
| rose | Rosa sp. |
| sage | Artemisea sp. |
| sagebrush | Artemisia cana |
| saskatoon | Amelanchier alnifolia |
| silverberry | Elaeagnus commutata |
| silver buffaloberry | Sheperdia argentea |
| silver sagebrush | Artemisia cana |
| snowberry | Symphoricarpos albus |
| spruce | Picea sp. |
| subalpine fir | Abies lasiocarpa |
| tamarack | Larix laricina |
| tea bush | Ceanothus velutinus |
| water birch | Betula occidentalis |
| wild gooseberry | Ribes sp. |
| willow | Salix sp. |
| white spruce | Picea glauca |

# APPENDIX 3
Continued ...

| COMMON NAMES | SCIENTIFIC NAMES |
|---|---|
| Graminoids | |
| barley | *Hordeum* sp. |
| bluegrass | *Poa* sp. |
| brome | *Bromus* sp. |
| bulrush | *Scirpus* sp. |
| cattail | *Typha latifolia* |
| corn | *Zea mays* |
| crested wheatgrass | *Agropyron cristatum* |
| fall rye | *Secale cereale* |
| fescue | *Festuca* sp. |
| flax | *Linum usitatissimum* |
| great bulrush | *Scirpus acutus* |
| hard-stem bulrush | *Scirpus* sp. |
| June grass | *Koeleria cristata* |
| manna grass | *Glyceria* sp. |
| melic grass | *Melica* sp. |
| oats | *Avena sativa* |
| reed grass | *Calamagrostis* sp. |
| Sandberg's bluegrass | *Poa secunda* |
| sedge | *Carex* sp. |
| slough grass | *Beckmannia* sp. |
| spike rush | *Eleocharis* sp. |
| timothy | *Phleum* sp. |
| western wheatgrass | *Agropyron smithii* |
| wheat | *Triticum* sp. |
| wheatgrass | *Agropyron* sp. |
| winter wheat | *Triticum* |
| Forbs | |
| alfalfa | *Medicago sativa* |
| arrowhead | *Sagittaria* sp. |
| butterfly weed | *Gaura coccinea* |

## APPENDIX 3
Continued ...

| COMMON NAMES | SCIENTIFIC NAMES |
|---|---|
| Forbs (cont'd) | |
| clover | *Trifolium* sp. |
| Colorado rubber-plant | *Hymenoxys richardsonii* |
| cow-parsnip | *Heracleum lanatum* |
| dandelion | *Taraxacum* sp. |
| doorweed | *Polygonum aviculare* |
| duckweed | *Lemna* sp. |
| fireweed | *Epilobium angustifolium* |
| glacier lily | *Erythronium grandiflorum* |
| golden aster | *Chrysopsis villosa* |
| hedysarum | *Hedysarum* sp. |
| horsetail | *Equisetum arvense* |
| lambsquarters | *Chenopodium album* |
| nettle | *Urtica* sp. |
| pasture sage | *Artemsia frigida* |
| pond-weed | *Potamogeton* sp. |
| smartweed | *Polygonum* sp. |
| sow thistle | *Sonchus* sp. |
| thistle | *Cirsium* sp. |
| waterlily | *Nuphar* sp. |
| water plantain | *Alisma* sp. |
| wild strawberry | *Fragaria virginiana* |
| wild tomato | *Solanum triflorum* |
| white top | *Erigeron* sp. |
| wooly yarrow | *Achillea millefolium* |
| yellow goat's beard | *Tragopogon dubius* |
| yellow pond lily | *Nuphar variegatum* |